



Does Money Matter in Education?

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SECOND EDITION



ALBERT SHANKER INSTITUTE



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Does Money Matter in Education?

EXECUTIVE SUMMARY

This second edition policy brief revisits the long and storied literature on whether money matters in providing a quality education. It includes research released since the original brief in 2012 and covers a handful of additional topics. Increasingly, political rhetoric adheres to the unfounded certainty that money doesn't make a difference in education, and that reduced funding is unlikely to harm educational quality. Such proclamations have even been used to justify large cuts to education budgets over the past few years. These positions, however, have little basis in the empirical research on the relationship between funding and school quality.

In the following brief, I discuss major studies on three specific topics: (a) whether how much money schools spend matters; (b) whether specific schooling resources that cost money matter; and (c) whether substantive and sustained state school finance reforms matter. Regarding these three questions, I conclude:

DOES MONEY MATTER?

Yes. On average, aggregate measures of per-pupil spending are positively associated with improved or higher student outcomes. The size of this effect is larger in some studies than in others, and, in some cases, additional funding appears to matter more for some students than for others. Clearly, there are other factors that may moderate the influence of funding on student outcomes, such as how that money is spent. In other words, money must be spent wisely to yield benefits. But, on balance, in direct tests of the relationship between financial resources and student outcomes, money matters.

DO SCHOOLING RESOURCES THAT COST MONEY MATTER?

Yes. Schooling resources that cost money, including smaller class sizes, additional supports, early childhood programs and more competitive teacher compensation (permitting schools and districts to recruit and retain a higher-quality teacher workforce), are

positively associated with student outcomes. Again, in some cases, those effects are larger than in others, and there is also variation by student population and other contextual variables. On the whole, however, the things that cost money benefit students, and there is scarce evidence that there are more cost-effective alternatives.

DO STATE SCHOOL FINANCE REFORMS MATTER?

Yes. Sustained improvements to the level and distribution of funding across local public school districts can lead to improvements in the level and distribution of student outcomes. While money alone may not be the answer, more equitable and adequate allocation of financial inputs to schooling provide a necessary underlying condition for improving the equity and adequacy of outcomes. The available evidence suggests that appropriate combinations of more adequate funding with more accountability for its use may be most promising.



While there may in fact be better and more efficient ways to leverage the education dollar toward improved student outcomes, we do know the following:

- Many of the ways in which schools currently spend money do improve student outcomes.
- When schools have more money, they have greater opportunity to spend productively. When they don't, they can't.
- Arguments that across-the-board budget cuts will not hurt outcomes are completely unfounded.

In short, money matters, resources that cost money matter, and a more equitable distribution of school funding can improve outcomes. Policymakers would be well-advised to rely on high-quality research to guide the critical choices they make regarding school finance.



Does Money Matter in Education?

FRAMING THE QUESTION

It is hard to imagine a time in the history of American public education when there has been such a widespread political effort to argue that improving the quality of schools has little or nothing to do with the amount of money spent on public education.

That is, that money simply doesn't matter.

Political certainty regarding the unimportance of money for schools and the need for schools to "tighten their belts" is frequently grounded in misrepresentations of total spending growth and test score trends at the national level over the past 30 years. The typical storyline is that while spending per pupil has increased dramatically and pupil-to-teacher ratios have declined,² scores on national assessments have stagnated and scores on international assessments have fallen behind the rest of the developed world.³ The conclusion: We're spending more and more, and not getting results, so it's clear that money doesn't make a difference.

To a large extent, the escalation of rhetoric is a sign of the times, in terms of both economic and political context. At the outset of the recent economic downturn, U.S. Secretary of Education Arne Duncan declared this to be the era of the "new normal," a period in which budget cutbacks are the norm and local public school districts must learn to do more with less.

At the state level, where the primary responsibility for financing public schools lies, this rhetoric has been particularly bold.

Florida Gov. Rick Scott, for example, in justifying his cuts to the state's education budget, remarked:

"We're spending a lot of money on education, and when you look at the results, it's not great."⁴

In his 2011 "State of the State" address, New York Gov. Andrew Cuomo declared:

"Not only do we spend too much, but we get too little in return. We spend more money on education than any state in the nation, and we are number 34 in terms of results."⁵

More recently, in reference to a legal challenge brought against New York State by small city school districts,

Cuomo opined:

"We spend more than any other state in the country. It ain't about the money. It's about how you spend it—and the results."⁶

In an interview with New Jersey Gov. Chris Christie, the *Wall Street Journal* reported:

"According to Mr. Christie, New Jersey taxpayers are spending \$22,000 per student in the Newark school system yet less than a third of these students graduate, proving that more money isn't the answer to better performance."⁷

And in conversations regarding federal education spending priorities, Virginia Rep. Dave Brat proclaimed:

"Socrates trained Plato in on a rock and then Plato trained in Aristotle roughly speaking on a rock. So, huge funding is not necessary to achieve the greatest minds and the greatest intellects in history." [sic]⁸

And so it is: We need only provide a sufficient collection of rocks to ensure educational adequacy. That is, setting aside the modern-day competitive wage required to recruit and retain philosophy instructors of the quality of Socrates and provide them 1-to-1 student-teacher ratios.

While political rhetoric is often divorced from empirically rigorous research, the echo chamber regarding the unimportance of funding for improving school quality has amplified, and has migrated to the entirely unsupportable proposition that funding cuts cause no harm. In other words, the political message has gone several steps beyond questioning whether a systematic relationship exists between funding and school quality—a classic research framing of the issue—to bold assertions that we now know, with certainty, that money doesn't matter and that the path to school improvement can be accomplished despite—or even because of—reductions in spending.

Whether political rhetoric is partly to blame, even as the economy has begun to rebound in most states, state school finance systems have become increasingly inequitable, with levels of state support for public schools stagnant at best. In a recently published article, I found that during the recession, state school finance systems took a substantial hit, both in terms of total state and local revenue and in terms of equity between districts serving lower- and higher-poverty student populations:

"The recent recession yielded an unprecedented decline



in public school funding fairness. Thirty-six states had a three-year average reduction in current spending fairness between 2008-09 and 2010-11, and 32 states had a three-year average reduction in state and local revenue fairness over that same time period. Over the entire 19-year period, only 15 states saw an overall decline in spending fairness. In years prior to 2008 (starting in 1993), only 11 states saw an overall decline in spending fairness.”⁹

A more recent report from the Center on Budget and Policy Priorities revealed that through 2014-15, most state school finance systems had not yet begun to substantively rebound:

“At least 30 states are providing less funding per student for the 2014-15 school year than they did before the recession hit. Fourteen of these states have cut per-student funding by more than 10 percent. (These figures, like all the comparisons in this paper, are in inflation-adjusted dollars and focus on the primary form of state aid to local schools.)

Most states are providing more funding per student in the new school year than they did a year ago, but funding has generally not increased enough to make up for cuts in past years. For example, Alabama is increasing school funding by \$16 per pupil this year. But that is far less than is needed to offset the state’s \$1,144 per-pupil cut over the previous six years.”¹⁰

In short, the decline of state school finance systems continues and the rhetoric opposing substantive school finance reform shows little sign of easing. Districts serving the neediest student populations continue to take the hardest hit. Yet, concurrently, many states are raising outcome standards for students¹¹ and increasing the consequences on schools and teachers for not achieving those outcome standards. Some positive signs include recent structural reforms in California and Pennsylvania, possibly involving new revenue, in each case focusing on districts serving high-poverty student populations. But other states that made substantial cuts during the economic downturn have continued to cut (Kansas) or largely freeze (New York) state aid, even under the pressure of prior and ongoing judicial review and oversight.

The growing political consensus that money doesn’t matter stands in sharp contrast to the substantial body of empirical research that has accumulated over time, but which gets virtually no attention in our public discourse.¹² This policy brief reviews that literature. Specifically, I review three major bodies of evidence, each of which pertains to a specific element of the broad topic of whether money matters in determining the quality of education. These three literatures are organized by the following guiding questions:

- 1. Does money matter?** Are differences in aggregate school funding associated with differences in short- and long-term measured outcomes?
- 2. Do school resources that cost money matter?** Are differences in access to specific schooling programs or resources—where “resources” mean the various things that money buys, such as smaller classes, higher salaries and instructional materials—associated with differences in short- and long-term measured outcomes?
- 3. Do school finance reforms matter?** Do substantive and sustained reforms to state school finance systems, including raising the level of funding or redistributing money more equitably, lead to improvements in the level or distribution of student outcomes?

I discuss only domestic studies, primarily those that focus on short-term and intermediate-term outcomes, such as achievement (e.g., test scores) and attainment (e.g., graduation). Furthermore, preference is given to studies that appear in peer-reviewed academic journals and books (see endnote 13 for the full selection criteria).¹³ I also discuss the sources of information that have been frequently used to cast doubt on whether money is related to educational outcomes. Finally, I summarize what we know from the preponderance of evidence, as derived from rigorous empirical analysis, as well as what we do not yet know. And in an appendix to this brief, I discuss, in general terms, methodological issues around the study of whether money matters in education.

FROM THE COLEMAN REPORT TO THE PRODUCTION FUNCTION

The saga over whether money matters in American public education can be traced back to the broader question of whether *schools* matter. That is, whether schools and school quality have any influence on student achievement, educational attainment and future earnings. The first national, large-scale quantitative analysis to explore this question was sociologist James Coleman’s widely cited “Equality of Educational Opportunity” report, which came about as part of the Civil Rights Act of 1964.¹⁴

Among other things, the Coleman report explored the relationship between school resource measures and student outcomes, finding little relationship between the two.



Using the (more limited) statistical techniques of the day, Coleman concluded that, on balance, the strongest correlations with student outcome measures were not found in schools but rather among factors related to parental income, parental education levels and resources in the home. That said, among school resource measures, Coleman did find that teacher characteristics were positively associated with student outcomes, and more strongly so for minority students compared with white students.¹⁵ Nonetheless, the implication drawn by many was that schools simply don't matter. An extension of this implication was that putting more money into schools to try to improve quality was unlikely to matter either.

However, recent re-analyses of the Coleman report data, using up-to-date statistical techniques and computing capacity, found that even Coleman's data indicate that schooling quality has significant effects on student outcomes. In one recent example, Konstantopolous and Borman (2011) conclude:

"Our results also indicated that schools play meaningful roles in distributing equality or inequality of educational outcomes to females, minorities, and the disadvantaged."¹⁶

In a related analysis, Borman and Dowling (2010) report:

"Even after statistically taking into account students' family background, a large proportion of the variation among true school means is related to differences explained by school characteristics."¹⁷

In short, while family background certainly matters most, schools matter as well. Furthermore, there exist substantive differences in school quality that explain a substantial portion of the variation in student outcomes.

Subsequent studies using alternative data sources explored the relationship between schooling quality and various outcomes, including the economic rate of return to schooling (e.g., future earnings). For example, Card and Krueger (1992) studied the relationship between school quality measures, including pupil-to-teacher ratios and relative teacher pay, and the rate of return to education for men born between 1920 and 1949. Card and Krueger found that men educated in states with higher-quality schools have a higher return to additional years of schooling. Rates of return were also higher for individuals from states with better-educated teachers.¹⁸

Similarly, Betts (1996) provided an extensive review of the literature that attempts to link measures of schooling quality and adult earnings, including Card and Krueger's study. Betts explains that, while the overall results of such studies were mixed, they were generally positive. More specifically, he pointed to more positive results for studies

evaluating the association between district-level spending and earnings, as opposed to those attempting to identify a link between *school*-level resources and earnings, for which results are murkier.¹⁹

The re-analyses of Coleman's data, coupled with subsequent credible findings using alternative data sources, served to discredit the original Coleman report findings (and more specifically, common interpretations of the report that schools and school quality matter little). It is now clear that schools matter.

IS AGGREGATE SPENDING CORRELATED WITH OUTCOME MEASURES?

After the release of the Coleman report, numerous scholars took advantage of new and richer data sources. They were largely focused on exploring in greater depth why schools didn't seem to matter—the common, and now discredited, interpretation of the Coleman report. In 1986, 20 years after Coleman, economist Eric Hanushek published a paper that would arguably become the most widely cited source for the claim that money simply doesn't matter when it comes to improving school quality and student outcomes.²⁰

The paper, a meta-analysis of the large collection of post-Coleman studies, used data from a variety of contexts, small and large, in the United States and elsewhere. Hanushek tallied the findings of those studies. Some found a positive relationship between spending and student outcomes, while others found no relationship or a negative one. He came to the following conclusion, which was italicized for emphasis in the original publication:

"There appears to be no strong or systematic relationship between school expenditures and student performance." (p. 1162)²¹

In the years that followed, this finding became a mantra for many politicians and advocates, and it has echoed through the halls of state and federal courthouses where school funding is deliberated. To this day, it has maintained an impressive air of credibility in many circles, although, as discussed below, the analyses behind it were refuted on numerous occasions by leading scholars in the decade that followed. Furthermore, as also shown below, many of the studies originally reviewed by Hanushek, which were published in the 1960s and 1970s, no longer pass muster methodologically, given advances in data quality, statistical techniques, and researchers' understanding of educational production and schooling quality.



In assessing Hanushek's conclusion, it is important to distinguish between *inconsistent* findings about the spending-outcomes relationship on the one hand, and bold declarations that money doesn't matter on the other. Within a developed body of research on almost any topic, there is always at least some degree of inconsistency in findings. The key is to adjudicate between studies in terms of their quality and scope, and to assess whether a general conclusion might be drawn from the preponderance of the high-quality evidence.

Accordingly, the most direct rebuttal to Hanushek's characterization of the findings of existing research came in a series of re-analyses by University of Chicago scholars Rob Greenwald, Larry Hedges and Richard Laine, who gathered the studies originally cited by Hanushek in 1986 and conducted meta-analyses of those that met certain quality parameters. They included studies that (a) had appeared in a refereed journal or book; (b) used U.S. data; (c) had outcome measures that were some form of academic achievement; (d) used data at the district or less-aggregate level; (e) employed a model that controlled for socioeconomic characteristics, fit with longitudinal data; and (f) included data that were independent of other data included in the universe of studies considered by Hanushek. Notably, these "quality control measures" pruned a significant share of studies²² used by Hanushek.

Specifically pertaining to aggregate per-pupil spending measures, Greenwald, Hedges and Laine (1996) found that, among statistically significant findings, the vast majority of study findings were positive (11:1), and that most of the analyses that did not find a statistically discernible relationship between spending and outcomes still found a positive association (p. 368). They concluded:

"Global resource variables such as PPE [per-pupil expenditures] show strong and consistent relations with achievement. In addition, resource variables that attempt to describe the quality of teachers (teacher ability, teacher education, and teacher experience) show very strong relations with student achievement." (p. 384)

Digging deeper and exploring the relationship between a variety of resource and student outcome measures, Greenwald, Hedges and Laine came to the conclusion that "a broad range of resources were positively related to student outcomes, with 'effect sizes' large enough to suggest that moderate increases in spending may be associated with significant increases in achievement" (p. 361).²³ This finding stands in sharp contrast to Hanushek's statement of uncertainty.

Other researchers, including Wenglinsky (1996), went on to explore with greater precision the measures of financial inputs to schooling that are most strongly associated

with variations in student outcomes. Largely confirming the meta-analyses of Greenwald, Hedges and Laine, Wenglinsky's analysis found that "per-pupil expenditures for instruction and the administration of school districts are associated with achievement because both result in reduced class size, which raises achievement" (p. 221).²⁴

More recent studies (later 1990s and early 2000s) examining the relationship between financial resources and student outcomes made incremental improvements to production function analyses by (a) adjusting the value of the education dollar for regional cost variation;²⁵ (b) testing alternative "functional forms" of the relationship between financial inputs and student outcomes; and (c) applying other statistical corrections for the measurement of inputs.²⁶ These studies have invariably found a positive, statistically significant (though at times small) relationship between student achievement gains and financial inputs.

They also, however, raised new, important issues about the complexities of attempting to identify a direct link between money and student outcomes. These difficulties include equating the value of the dollar across widely varied geographic and economic contexts, as well as accurately separating the role of expenditures from that of students' family backgrounds, which also play some role in determining local funding. Most of the studies included in Hanushek's review suffered from serious data and methodological limitations, which have since been addressed in more recent work.²⁷

Interest in direct dollar-to-outcomes analysis also stalled due to the imprecision of data on financial resources available to school sites and children. Most existing financial data continue to be reported at the school district level, but resources may vary widely across schools within these districts. As a result, questions about whether money matters are often restricted to linking district-level funding with student-level outcomes, which ignores the manner in which district funds are distributed among schools. School-site spending data are increasingly available but have not generally been the subject of new production function studies. That is, few studies have as yet evaluated the relationship between school-level spending and student-level outcomes. Instead, researchers have increasingly focused on "within school" factors that are thought to influence student outcomes, including schooling resources, such as class sizes and teacher characteristics, which are often more easily linked in datasets to schools and classrooms.²⁸

To summarize this discussion on whether resources matter, it is important to recognize that Hanushek's original conclusion from 1986 was merely a statement of "uncertainty" about whether a *consistent* relationship exists between spending and student outcomes—one that is big enough to be important. His conclusion was *not* that such a relationship does



not exist. Nor was it a statement that schools with fewer resources are better, or that reducing funding can be an effective way to improve schools.

By the early 2000s, the cloud of uncertainty conjured by Hanushek in 1986 had largely lifted in the aftermath of the various, more rigorous studies that followed, with finance scholars using detailed datasets to examine more finely grained relationships between money and student outcomes.

The uncertainty has been replaced with an empirically grounded confidence that funding does matter.

DO RESOURCES MATTER?

Analyzing the relationship between *overall* spending and outcomes is a limited tool. Some things work and others do not—a high-spending state or district that allocates resources to ineffective policies might not show results, and vice versa. In short, it's not just how much you spend but how you spend it. Accordingly, both parallel with, and emergent from, the literature exploring whether aggregate measures of per-pupil spending are positively associated with student outcomes, there are now numerous studies of how specific schooling resources affect student outcomes. Typically, these studies have explored measures including (but not limited to):

1. Teacher salaries; and
2. Pupil-to-teacher ratios (class sizes).

Both of these resource measures have financial implications. Thus, it is natural, when exploring whether money matters, to explore whether things that cost money matter.²⁹

Teacher quality and wages

The Coleman report looked at a variety of specific schooling resource measures, most notably teacher characteristics, finding positive relationships between these traits and student outcomes. A multitude of studies on the relationship between teacher characteristics and student outcomes have followed, producing mixed messages as to which characteristics matter most and by how much.³⁰ Inconsistent findings on the relationship between teacher “effectiveness” and how teachers get paid—by experience and education—added fuel to the “money doesn’t matter” fire. Since a large proportion of school spending necessarily goes to teacher compensation, and (according to this argument) since we’re not paying teachers in a manner that reflects or incentivizes their productivity, then spend-

ing more money won’t help.³¹ In other words, the assertion is that money spent on the current system doesn’t matter, but it could if the system was to change.

Of course, in a sense, this is an argument that money *does* matter. But it also misses the important point about the role of experience and education in determining teachers’ salaries, and what that means for student outcomes.

While teacher salary schedules may determine pay differentials across teachers *within* districts, the simple fact is that *where* one teaches is also very important in determining how much he or she makes.³² Arguing over attributes that drive the raises in salary schedules also ignores the bigger question of whether paying teachers more in general might improve the quality of the workforce and, ultimately, student outcomes. Teacher pay is increasingly uncompetitive with salaries offered by other professions, and the “penalty” teachers pay increases the longer they stay on the job.³³

A substantial body of literature has accumulated to validate the conclusion that teachers’ overall wages and relative wages affect the quality of those who choose to enter the teaching profession, and whether they stay once they get in. For example, Murnane and Olson (1989) found that salaries affect the decision to enter teaching and the duration of the teaching career,³⁴ while Figlio (1997, 2002) and Ferguson (1991) concluded that higher salaries are associated with more qualified teachers.³⁵ In addition, more recent studies have tackled the specific issues of relative pay noted above. Loeb and Page (2000) showed that:

“Once we adjust for labor market factors, we estimate that raising teacher wages by 10 percent reduces high school dropout rates by 3 percent to 4 percent. Our findings suggest that previous studies have failed to produce robust estimates because they lack adequate controls for non-wage aspects of teaching and market differences in alternative occupational opportunities.”³⁶

In short, while salaries are not the only factor involved, they do affect the quality of the teaching workforce, which in turn affects student outcomes.

Research on the flip side of this issue—evaluating spending constraints or reductions—reveals the potential harm to teaching quality that flows from leveling down or reducing spending. For example, Figlio and Rueben (2001) note: “Using data from the National Center for Education Statistics we find that tax limits systematically reduce the average quality of education majors, as well as new public school teachers in states that have passed these limits.”³⁷

Salaries also play a potentially important role in improving the *equity* of student outcomes. While several studies show that higher salaries relative to labor market norms can draw higher-quality candidates into teaching, the evidence



also indicates that relative teacher salaries across schools and districts may influence the distribution of teaching quality. For example, Ondrich, Pas and Yinger (2008) find that “teachers in districts with higher salaries relative to non-teaching salaries in the same county are less likely to leave teaching and that a teacher is less likely to change districts when he or she teaches in a district near the top of the teacher salary distribution in that county.”³⁸

With regard to teacher quality and school racial composition, Hanushek, Kain and Rivkin (2004) note: “A school with 10 percent more black students would require about 10 percent higher salaries in order to neutralize the increased probability of leaving.”³⁹ Others, however, point to the limited capacity of salary differentials to counteract attrition by compensating for working conditions.⁴⁰

In a perfect world, we could tie teacher pay directly to productivity, but contemporary efforts to do so, including performance bonuses based on student test results, have generally failed to produce concrete results in the United States.⁴¹ Recently published studies of individual and group financial incentives continue to find mixed to null effects,⁴² although alternative compensation models in some settings have yielded positive results. Dee and Wyckoff (2014) find some evidence that a comprehensive strategy combining teacher evaluation and financial incentives can yield marginal improvements to the average rate of student achievement growth among retained teachers.⁴³ Similarly, in a study of an Austin, Texas, pay-for-performance (P4P) program, Balch and Springer (2015) found that the school district’s “REACH program is associated with positive student test score gains in both math and reading during the initial year of implementation. Student test score gains are maintained in the second year, but we do not find any additional growth.”⁴⁴ Sojourner and colleagues (2014) found: “Exploiting district variation in participation status and timing, we find evidence that P4P-centered HRM [human resource management] reform raises students’ achievement by 0.03 standard deviations.”⁴⁵ In a more extreme application of financial incentives, characterized as “loss aversion,” Fryer and colleagues (2012) study the effect of providing teachers’ bonuses in advance and taking the money back if students do not improve sufficiently. They find that this approach “yields math test score increases between 0.2 and 0.4 standard deviations. This effect is on par with the impact of increasing teacher quality by more than one standard deviation.”⁴⁶

Still missing in this literature are cost-effectiveness comparisons of the alternatives. That is, if we take the same total payroll dollars and allocate those dollars traditionally across teachers with incremental differences in salaries by experience and credentials held, as opposed to implementing those salaries and bonuses by the above alternatives (along with paying for the associated costs of the

evaluation metrics used for allocating salaries), do we see differences in the production of student outcomes? That is, can comparable or better outcomes be achieved where the summed costs of alternative compensation and producing metrics for allocating that compensation are equal to or less than current costs?

Assertions that performance-based pay is necessarily more cost-effective than traditional salary structures also falsely assume traditional step-and-lane salary schedules to be monolithic. In practice, salary differentials associated with experience and credentials vary widely. Some are compressed from top to bottom, while others are not, and they may favor experience over credentials or vice versa. Hendricks (2015a, 2015b) explores these issues:

“Increasing salaries for teachers with 3 or more years of experience differentially retains high-ability teachers, while higher salaries for teachers with 0-2 years of experience differentially retain low-ability teachers. This likely occurs because higher early-career salaries disrupt a positive sorting process that exists among novice teachers.”⁴⁷

That is, one might restructure traditional salary schedules to achieve gains comparable to or greater than deeper structural changes to compensation. Hendricks also finds that changing salary structures may alter recruitment potential and the recruiting pool:

“Overall, a 1% increase in base salary for teachers of a particular experience level increases the proportion of the targeted teachers hired by 0.04-0.08 percentage points. Pay increases have the largest effect on hire rates among teachers with 2-3 years of experience and the effect diminishes with experience. I show that higher teacher salaries provide a dual benefit of retaining and attracting a more effective distribution of teachers. Districts may also improve student achievement growth at no cost by reshaping their salary schedules so that they are increasing and concave in teacher experience.”⁴⁸

In the wake of growing literature and policy rhetoric asserting the inefficiency of paying teachers according to experience and credentials, a handful of new studies have surfaced revealing that the gains in student outcomes resulting from increased teacher experience may extend well beyond the first few years of experience.⁴⁹ Thus, it would not be entirely inefficient for salaries to continue scaling upward with increased experience, especially given additional costs of implementing alternative measures on which to base salaries. Wiswall (2013) finds:

“Using an unrestricted experience model I find that for mathematics achievement there are high returns to later career teaching experience, about twice as



much dispersion in initial teacher quality as previously estimated, and a pattern of negative selection where high quality teachers are more likely to exit.”⁵⁰

Papay and Kraft (2015) find:

“Consistent with past research, we find that teachers experience rapid productivity improvement early in their careers. However, we also find evidence of returns to experience later in the career, indicating that teachers continue to build human capital beyond these first years.”⁵¹

Ladd and Sorensen (2014) find:

“Once we control statistically for the quality of individual teachers by the use of teacher fixed effects, we find large returns to experience for middle school teachers in the form both of higher test scores and improvements in student behavior, with the clearest behavioral effects emerging for reductions in student absenteeism. Moreover these returns extend well beyond the first few years of teaching.”⁵²

Perhaps most importantly, the overall efficiency and effectiveness of teacher compensation does not depend exclusively on the extent to which each dollar allocated to any and every teacher’s salary can be associated precisely with a measurable, marginal gain to the test scores of children linked with that teacher. First, benefits of schooling extend beyond short-term achievement gains. Second, teacher compensation exists, and exerts whatever influence it may have, within a complex social and economic system. Thoughtful expositions considering these complex dynamics are few and far between. Two recent examples, however, include a largely theoretical piece, supported by longitudinal descriptive data by Gilpin and Kaganovich (2011), and a recent National Bureau of Economic Research paper by Rothstein (2012).

Gilpin and Kaganovich (2011) propose a general equilibrium model of teacher quantity and quality adopting the premise that teachers’ relative wages (to other sectors) are critical to maintaining a quality teaching workforce. Additionally, compression of salaries (at the high end) may reduce retention and recruitment of talented teachers. Illustrated in their data, the long-term increase in teacher quantity has led to lagging wage competitiveness, thus potentially compromising labor quality. But so too has growth in wages of competing sectors. They explain that a rise in premium for high ability will outpace that for the average. These increase costs are not offset by technological change, hence an additional downward pressure on the “real” quality of education inputs. The costs of high quality labor are increasing faster than the resources required to pay the premiums that simply maintain quality, and there exist no viable technological substitutes to offset those increases. As such, we can expect the real quality of educational inputs to decline. Because of the rise in premium for

high ability, Gilpin and Kaganovich assert that “countering this trend would therefore require an increase in the share of GDP spent on basic education, assuming that the institutional setup of the school system remains unchanged” (428). In other words, because talent is becoming more expensive more rapidly in other sectors, more investment, as a share of GDP, may be required merely to maintain education quality. That said, this theoretical exposition, while built on much the same research base as I review herein and previously, is not fully vetted in the present article.

Rothstein (2012) critiques the presumption that tying teacher pay directly to measures of performance outcomes would necessarily improve efficiency of money allocated to compensation. He explains:

“Simulations indicate that labor market interactions are important to the evaluation of alternative teacher contracts. Typical bonus policies have very small effects on selection. Firing policies can have larger effects, if accompanied by substantial salary increases. However, misalignment between productivity and measured performance nearly eliminates the benefits while preserving most of the costs.”⁵³

And so it goes—while we have some new evidence that alternative compensation methods and evaluation metrics may yield some positive results, we do not as of yet have a deeper understanding of the relative cost-effectiveness of alternatives. Further, we have some evidence that restructuring compensation—while still based on traditional metrics (experience and credentials)—may have positive effects on teacher recruitment and retention. What we do know in each case is that the overall level of teacher compensation continues to matter for recruitment of talent into the teaching profession, relative to other labor market opportunities. Further, the relative compensation of teachers across settings within labor markets continues to matter.

To summarize, despite all the uproar about paying teachers based on experience and education, and its misinterpretations in the context of the “Does money matter?” debate, this line of argument misses the point. To whatever degree teacher pay matters in attracting high-quality educators into the profession and retaining them, it’s less about *how* they are paid than *how much*. Furthermore, the average salaries of the teaching profession, with respect to other labor market opportunities, can substantively affect the quality of entrants to the teaching profession, applicants to preparation programs and student outcomes. Diminishing resources for schools can constrain salaries and reduce the quality of the labor supply. Further, salary differentials between schools and districts might help to recruit or retain teachers in high-need settings. In other words, resources used for teacher quality matter.



Class size and teacher quantity

Class size is often characterized as a particularly expensive use of additional school dollars.⁵⁴ Reducing class sizes obviously costs money, since you have to hire additional teachers, but the question of whether it's expensive must rely on detailed comparisons of alternative uses of the same dollars, or the effects on student outcomes of those alternative uses.

Instead, most arguments against class size reduction frequently proceed by noting that there are significant costs to adding more teachers and classrooms (which is, again, an unsurprising revelation),⁵⁵ followed by a (often vague) statement as to the differences between the most and least "effective" teachers (as measured by their effects on test scores). The problem here is that one cannot compare the cost-effectiveness of class size reduction with "improving teacher quality," which is an outcome, not a concrete policy with measurable costs and benefits.

What we do know, however, is that ample research indicates that children in smaller classes achieve better outcomes, both academic and otherwise, and that class size reduction can be an effective strategy for closing racial and socioeconomic achievement gaps.⁵⁶ For example, Krueger (1999), in a re-analysis of data from the large-scale randomized Tennessee Project STAR class size reduction study, concluded:

"The main conclusions are 1) on average, performance on standardized tests increases by four percentile points the first year students attend small classes; 2) the test score advantage of students in small classes expands by about one percentile point per year in subsequent years; 3) teacher aides and measured teacher characteristics have little effect; 4) class size has a larger effect for minority students and those on free lunch."⁵⁷

Among more recent studies on the topic, also re-evaluating the Tennessee STAR data, Konstantopolous and Chun (2009) wrote:

"We used data from Project STAR and the Lasting Benefits Study to examine the long-term effects of small classes on the achievement gap in mathematics, reading, and science scores (Stanford Achievement Test). The results consistently indicated that all types of students benefit more in later grades from being in small classes in early grades. These positive effects are significant through grade 8. Longer periods in small classes produced higher increases in achievement in later grades for all types of students. For certain grades, in reading and science, low achievers seem to benefit more from being in small classes for longer periods. It appears that the lasting benefits of the cumulative effects of small classes may reduce the achievement gap in reading and science in some of the later grades."⁵⁸

Researchers continue to revisit data from the Tennessee STAR study, which in more recent years has permitted researchers to explore long-term outcomes of those students experimentally subjected to smaller class sizes. For example, Dynarski, Hyman and Schanzenbach (2013) find:

"Assignment to a small class increases the probability of attending college by 2.7 percentage points, with effects more than twice as large among blacks. Among students enrolled in the poorest third of schools, the effect is 7.3 percentage points. Smaller classes increase the likelihood of earning a college degree by 1.6 percentage points and shift students towards high-earning fields such as STEM (science, technology, engineering and mathematics), business and economics. We find that test score effects at the time of the experiment are an excellent predictor of long-term improvements in postsecondary outcomes."⁵⁹

Admittedly, there remain some naysayers on whether class size reduction yields cost-effective benefits in terms of student outcomes. But the findings upon which these counterarguments are based often lack the weight of large-scale randomized studies, such as Tennessee's Project STAR, relying instead on natural variations in class sizes across schools.⁶⁰

Assertions of excessive cost and inefficiency of class size reduction often lack rigorous cost-effectiveness analysis. In a 2011 brief for the Center for American Progress, for example, author Matthew Chingos asserted that class size reduction is the "most expensive school reform."⁶¹ But that same report provided no direct cost or cost-effectiveness comparisons between class size reduction and other alternatives. A more recent review by Chingos (2013) published as a policy paper in the *Journal of Policy Analysis and Management* criticized class size reduction as broad state-imposed policy, revisiting the costs and potential downsides of statewide class size reduction policies implemented in California and Florida.⁶² Chingos suggests that estimates of long-term earnings of students subjected to class size reduction do not justify the cost,⁶³ but he also acknowledges that sufficient direct comparisons between spending on class size reduction and other alternatives are few and far between.

Dynarski, Hyman and Schanzenbach (2013) provide the most direct cost-effectiveness comparison of class size reduction policies with other options for which sufficient data on costs and outcome benefits were available:

"A fair conclusion from this analysis is that the effects we find in this paper of class size on college enrollment alone are not particularly large given the costs of the program. If focused on students in the poorest third of schools, then the cost-effectiveness of class size reduction is within the range of other interventions. There is no systematic evidence that early interventions pay of more than later ones when the outcome is



limited to increased college attendance.”⁶⁴

It’s true that a large body of the literature on the effectiveness of class size reduction relies on data from a relatively small group of sources, most notably, the Tennessee STAR experiment.⁶⁵ Further, most class size reduction studies finding substantial benefits have focused on class size reduction in early grades (K-3), and most of these programs are pilots implemented on a relatively small scale. (A comprehensive review of the literature on class size reduction is beyond the scope of this brief, but see endnote 66 for additional resources.)⁶⁶

It’s also true that reducing class size costs more than not reducing class size. But class size reductions, implemented effectively, have positive effects. As such, one can reasonably infer that using increased resources to reduce class sizes would have positive effects, or that resources matter.

While it’s certainly plausible that other uses of the same money might be equally or even more effective, there is little evidence to support this. For example, while we are quite confident that higher teacher salaries lead to increases in the quality of applicants to the teaching profession and increases in student outcomes, we do not know whether the same money spent toward salary increases would achieve better or worse outcomes if it were spent toward class size reduction. Indeed, some have raised concerns that large-scale class size reductions can lead to unintended labor market consequences that offset some of the gains attributable to class size reduction (such as the inability to recruit enough fully qualified teachers).⁶⁷ And many, over time, have argued the need for a more precise cost-benefit analysis.⁶⁸ Still, the preponderance of existing evidence suggests that the additional resources expended on class size reductions do result in positive effects.

DO SCHOOL FINANCE REFORMS MATTER?

A particularly relevant question for informing the current “Does money matter?” debate is whether increased and sustained funding provided through state school finance reforms can improve the level or distribution of student outcomes, including both long-term outcomes and short-term shifts in academic achievement. In other words, does the manner in which states distribute money matter? And how can we tell? Findings regarding these specific questions might, most directly, inform state legislative debates over tax policy and education spending.

Most funding for public education comes from state and local sources and is under the jurisdiction of state school

finance systems. Therefore, states have the greatest control over whether local public schools have access to sufficient levels of resources, and whether those resources are distributed equitably across children and settings. Furthermore, constitutional protections for children’s access to adequate and equitable public schooling exist in state constitutions, not in the U.S. Constitution. Finally, as indicated at the outset of this brief, it is at the state level where the most raucous rhetoric is occurring around these questions of whether money matters in education. State legislatures and governors can make or break public schooling, and they have.⁶⁹

Kevin Welner of the University of Colorado and I published an extensive review on this specific topic, which appears in the November 2011 issue of *Teachers College Record*. Among other things, we address the research complexities of answering questions about the efficacy of state school finance reforms. Those complexities can often be reduced to asking the right questions about (a) whether substantive reforms were actually implemented; (b) when they were implemented and how long they were sustained; and (c) who was most affected by the reforms.

As with other bodies of literature on the effectiveness of schooling resources, the research on state school finance reforms is a mixed bag in terms of analytic rigor. Second-hand references to dreadful failures following massive infusions of new funding can often be traced to methodologically inept, anecdotal tales of desegregation litigation in Kansas City, Mo., or to the court-ordered financing of urban districts in New Jersey.⁷⁰

In 2009, Eric Hanushek and a consulting defense attorney for states facing school funding challenges, Alfred Lindseth of Sutherland Asbill & Brennan, produced a book in which one chapter is dedicated to trying to prove that court-ordered school funding reforms in New Jersey, Wyoming, Kentucky and Massachusetts resulted in few or no measurable improvements.⁷¹ These conclusions, however, are based on little more than a series of graphs of student achievement on the National Assessment of Educational Progress in 1992 and 2007. The authors show little change in these states’ scores and conclude that the reforms didn’t work.

The authors assume that, during this period, each of the four states infused substantial additional funds into public education in response to judicial orders, and that these funds were targeted at low-income and minority students.^{72/73} They also necessarily assume that in all other states that serve as a comparison group, similar changes did not occur. Yet they validate neither assertion.

In contrast, Welner and I review several studies applying more rigorous and appropriate methods for evaluating the influence of state school finance reforms. Among these



analyses is one national study by Card and Payne (2002) that evaluates whether changes in spending inequality generally lead to changes in outcome inequality.⁷⁴ The authors measure both the extent and the timing of changes in each. These analyses, while imperfect, rise to a level far above those conducted by Hanushek and Lindseth. Card and Payne found “evidence that equalization of spending levels leads to a narrowing of test score outcomes across family background groups” (p. 49).⁷⁵

Additional compelling studies have been published since my review in 2011. In 2014 and 2015, Kirabo Jackson, Rucker Johnson and Claudia Persico (JJP) released a series of NBER working papers and articles summarizing their analyses of a uniquely constructed national data set in which they evaluate the long-term effects of selective, substantial infusions of funding to local public school districts, which occurred primarily in the 1970s and 1980s, on high school graduation rates and eventual adult income. Virtues of the JJP analysis include that the analysis provides clearer linkages than many prior studies between the mere presence of “school finance reform,” the extent to which school finance reform substantively changed the distribution of spending and other resources across schools and children, and the outcome effects of those changes. The authors also go beyond the usual short-run connections between changes in the level and distribution of funding, and changes in the level and distribution of test scores, to evaluate changes in the level and distribution of educational attainment, high school completion, adult wages, adult family income and the incidence of adult poverty.

To do so, the authors use data from the Panel Study of Income Dynamics on “roughly 15,000 PSID sample members born between 1955 and 1985, who have been followed into adulthood through 2011.” The authors’ analysis rests on the assumption that these individuals, and specific individuals among them, were differentially affected by the infusions of resources resulting from school finance reforms that occurred during their years in K-12 schooling. One methodological shortcoming of this long-term analysis is the imperfect connection between the treatment and the population that received that treatment.⁷⁶ The authors matched childhood address data to school district boundaries to identify whether a child attended a district likely subject to additional funding as a result of court-mandated school finance reform. While imperfect, this approach creates a tighter link between the treatment and the treated than exists in many prior national, longitudinal and even state-specific school finance analyses.⁷⁷

Regarding the effects of school finance reforms on long-term outcomes, the authors summarize their findings as follows:

“Thus, the estimated effect of a 22 percent increase in per-pupil spending throughout all 12 school-age years for low-income children is large enough to eliminate

the education gap between children from low-income and nonpoor families. In relation to current spending levels (the average for 2012 was \$12,600 per pupil), this would correspond to increasing per-pupil spending permanently by roughly \$2,863 per student.

“Specifically, increasing per-pupil spending by 10 percent in all 12 school-age years increases the probability of high school graduation by 7 percentage points for all students, by roughly 10 percentage points for low-income children, and by 2.5 percentage points for nonpoor children.

“For children from low-income families, increasing per-pupil spending by 10 percent in all 12 school-age years boosts adult hourly wages by \$2.07 in 2000 dollars, or 13 percent.”⁷⁸

The findings of this study have been met with some criticism. Specifically, Eric Hanushek has asserted that these findings of strong, positive longitudinal effects of school finance reforms on student outcomes, running between 1972 and 2011, are entirely inconsistent with his characterization of long-term trends in school spending and national average test scores. According to Hanushek, if the effects JJP describe are real, then the massive infusions of funding to public education over time would have mitigated achievement gaps and substantially driven up national averages. Hanushek explains:

“Their analysis covers schooling experiences for the period 1970-2010. Thus, it is useful to connect these estimates to actual funding patterns over the period. Between 1970 and 1990, real expenditure per pupil increased not by 10 percent but by over 84 percent. By 2000, this comparison with 1970 topped 100 percent, and it reached almost 150 percent by 2010. No amount of adjustment for special education, LEP, or what have you will make these extraordinary increases in school funding go away.

“If a ten percent increase yields the results calculated by Jackson, Johnson, and Persico, shouldn’t we have found all gaps gone (and even reversed) by now due to the actual funding increases? And, even with small effects on the non-poor, shouldn’t we have seen fairly dramatic improvements in overall educational and labor market outcomes? In reality, in the face of dramatic past increases in school funding, the gaps in attainment, high school graduation, and family poverty have remained significant, largely resisting any major improvement. And, the stagnating labor market performance for broad swaths of the population has captured considerable recent public and scholarly attention.”

Perhaps the most illogical assertion of Hanushek is that applying the effect of funding increases estimated by JJP to the actual long-term growth in national average per-pu-



pil spending would lead to the elimination or reversal of achievement gaps. As such, since gaps have not been eliminated or reversed, JJP's estimates must be wrong. Neither JJP's nor Hanushek's national average spending data indicate that all spending increases from 1970 to 2010 were targeted to all high-poverty districts nationwide. If Hanushek's average spending increases were driven as much by increases in wealthy (low poverty/minority) districts as they were by increases in poorer districts, then gaps would likely remain constant, all else being equal.⁷⁹ The identification of substantial gains in lifelong outcomes for children in districts that did experience increased funding indicates that greater gains perhaps could have been achieved for children in lower-wealth, higher-poverty communities, if funding increases had been more systematically targeted to those communities, nationwide, throughout the time period.

Thus, the critical reviewer must ask whether the data, methods and analytic approach applied by JJP are sufficiently more rigorous, and thus provide more compelling evidence, than the long-term trend exposition of Hanushek. The simple answer to that is yes.

A secondary critique offered by Hanushek is that the funding increases evaluated by JJP occurred largely in the 1970s and early 1980s, when overall spending was much lower, thus making marginal gains potentially more important than now, when spending has reached and stabilized at inefficiently high levels across the board. Notably, however, JJP's analyses span a longer period than merely the early 1970s and also span multiple contexts of higher and lower spending over the period. While subsequent replications of JJP's findings and further exploration of their data will provide additional insights, the current studies provide compelling evidence that school finance reforms can be leveraged to equalize educational and long-term economic opportunity.

JJP also address the question of how money is spent, and, in a response to Hanushek, explain that they too concur that how money is spent is important. An important feature of the JJP study is that it does explore the resultant shifts in specific schooling resources in response to shifts in funding. For the most part, increased spending led to increases in typical schooling resources, including higher educator salaries, smaller classes, and longer school days and years. JJP explain:

"We find that when a district increases per-pupil school spending by \$100 due to reforms, spending on instruction increases by about \$70, spending on support services increases by roughly \$40, spending on capital increases by about \$10, while there are reductions in other kinds of school spending, on average.

"We find that a 10 percent increase in school spending is

associated with about 1.4 more school days, a 4 percent increase in base teacher salaries, and a 5.7 percent reduction in student-teacher ratios. Because class-size reduction has been shown to have larger effects for children from disadvantaged backgrounds, this provides another possible explanation for our overall results.

"While there may be other mechanisms through which increased school spending improves student outcomes, these results suggest that the positive effects are driven, at least in part, by some combination of reductions in class size, having more adults per student in schools, increases in instructional time, and increases in teacher salaries that may help to attract and retain a more highly qualified teaching workforce."

In other words, oft-maligned traditional investments in schooling resources occurred as a result of court-imposed school finance reforms, and those changes in resources were likely responsible for the resultant long-term gains in student outcomes. Such findings are particularly consistent with recent summaries and updated analyses of data on class size reduction.

Several state-specific longitudinal studies of school finance reforms support the JJP findings. Figlio (2004) explains that the influence of state school finance reforms on student outcomes is perhaps better measured *within* states over time, explaining that national studies of the type attempted by Card and Payne confront problems that include (a) the enormous diversity in the nature of state aid reform plans; and (b) the paucity of national student performance data.⁸⁰ Accordingly, more recent peer-reviewed studies of state school finance reforms have applied longitudinal analyses within specific states. And several such studies provide compelling evidence of the potential positive effects of school finance reforms.

Studies of Michigan school finance reforms of the 1990s have shown positive effects on student performance in both the previously lowest-spending districts⁸¹ and previously lower-performing districts.⁸² For instance, Roy (2011) found that Michigan's school finance reforms of the 1990s led to a significant increase among previously low-spending districts. Roy, whose analyses measure both *whether* the policy resulted in changes in funding and *who* was affected, found that Michigan's school finance plan "was quite successful in reducing interdistrict spending disparities. There was also a significant positive effect on student performance in the lowest-spending districts as measured in state tests" (abstract).⁸³

Similarly, Papke (2001), also evaluating Michigan school finance reforms of the 1990s, found that "increases in spending have nontrivial, statistically significant effects on math test pass rates, and the effects are largest for schools



with initially poor performance” (p. 821).⁸⁴

Most recently, Hyman (2013) also found positive effects of these Michigan school finance reforms, but the paper raised some concerns regarding the distribution of those effects. Hyman found that much of the increase was targeted to schools serving fewer low-income children. However, the study did find that students exposed to “\$1,000, or 12%, more spending per year during grades four through seven experienced a 3.9 percentage point increase in the probability of enrolling in college, and a 2.5 percentage point increase in the probability of earning a degree” (p. 1).⁸⁵

A similar peer-reviewed article by Deke (2003) evaluated “leveling up” of funding for very low-spending districts in Kansas, following a 1992 lower court threat to overturn the funding formula (without formal ruling to that effect). The article found that a 20 percent increase in spending was associated with a 5 percent increase in the likelihood of students going on to postsecondary education (p. 275).⁸⁶

Elsewhere, three studies of Massachusetts school finance reforms from the 1990s find similar results. The first, a non-peer-reviewed report by Downes, Zabel and Ansel (2009) explored, in combination, the influence on student outcomes of accountability reforms and changes to school spending. They found that “some of the research findings show how education reform has been successful in raising the achievement of students in the previously low-spending districts” (p. 5).⁸⁷ The second study, an NBER working paper by Guryan (2001), focused more specifically on the redistribution of spending resulting from changes to the state school finance formula. Guryan found that “increases in per-pupil spending led to significant increases in math, reading, science, and social studies test scores for 4th- and 8th-grade students. The magnitudes imply that a \$1,000 increase in per-pupil spending leads to about a third to a half of a standard-deviation increase in average test scores. It is noted that the state aid driving the estimates is targeted to under-funded school districts, which may have atypical returns to additional expenditures” (p. 1).⁸⁸ The most recent of the three, published in 2014 in the *Journal of Education Finance*, found that “changes in the state education aid following the education reform resulted in significantly higher student performance” (p. 297).⁸⁹

Finally, Downes (2004) conducted earlier studies of Vermont school finance reforms of the late 1990s (Act 60), noting:

“All of the evidence cited in this paper supports the conclusion that Act 60 has dramatically reduced dispersion in education spending and has done this by weakening the link between spending and property wealth. Further, the regressions presented in this paper offer some evidence that student performance has become more equal in the post-Act 60 period.

And no results support the conclusion that Act 60 has contributed to increased dispersion in performance” (p. 312).^{90,91}

On balance, it is safe to say that a sizeable and growing body of rigorous empirical literature validates that state school finance reforms can have substantive, positive effects on student outcomes, including reductions in outcome disparities and increases in overall outcome levels. It is also safe to say that the analyses provided by Hanushek and Lindseth (2009) and others⁹² who have tried to prove that court-ordered school funding reforms result in few or no measurable improvements offer little credible evidence, due to significant methodological omissions. In other words, not only does money matter, but reforms that determine how money is distributed matter too.

Flipping the function: Higher outcomes cost more

Earlier in this report, I addressed the education *production function* literature that seeks to establish a direct link between resources spent on schools and districts, and outcomes achieved by students. Production function studies include studies of how variation in resources across schools and settings is associated with variations in outcomes across those settings, and whether changes in resources lead to changes in the level or distribution of outcomes.

The education cost function is the conceptual flip side of the education production function. Like production function research, cost function research seeks to identify the link between spending variation and outcome variation, cross-sectionally and longitudinally. The goal of the education cost function is to discern the levels of spending associated with efficiently producing specific outcome levels (the “cost” per se) across varied geographic contexts and schools serving varied student populations. Most published studies applying cost function methodology use multiple years of district-level data, within a specific state context, and focus on the relationship between cross-district (over time) variations in spending and outcome levels, considering student characteristics, contextual characteristics such as economies of scale, and labor cost variation. Districts are the unit of analysis because they are the governing unit charged with producing outcomes, raising and receiving the revenues, and allocating the financial and human resources for doing so. Some cost function studies evaluate whether varied expenditures are associated with varied levels of outcomes, all else being equal, while other cost function studies evaluate whether varied expenditures are associated with varied growth in outcomes.



The existing body of cost function research has produced the following (in some cases obvious) findings:

1. The per-pupil costs of achieving higher-outcome goals tend to be higher, across the board, than the costs of achieving lower-outcome goals, all else being equal.⁹³
2. The per-pupil costs of achieving any given level of outcomes are particularly sensitive to student population characteristics. In particular, as concentrated poverty increases, the costs of achieving any given level of outcomes increase significantly.⁹⁴
3. The per-pupil costs of achieving any given level of outcomes are sensitive to district structural characteristics, most notably, economies of scale.⁹⁵

Researchers have found cost functions of particular value for evaluating the different costs of achieving specific outcome goals across settings and children. In a review of cost analysis methods in education, Downes (2004) explains: “Given the econometric advances of the last decade, the cost-function approach is the most likely to give accurate estimates of the within-state variation in the spending needed to attain the state’s chosen standard, if the data are available and of a high quality” (p. 9).⁹⁶

This body of literature also has its detractors, including, most notably, Robert Costrell, Eric Hanushek and Susanna Loeb (CHL), who, in a 2008 article, assert that cost functions are invalid for estimating costs associated with specific outcome levels. They assert that one cannot possibly identify the efficient spending level associated with achieving any desired outcome level by evaluating the spending behavior of existing schools and districts, whose spending is largely inefficient (because, as discussed above, district expenditures are largely tied up in labor agreements that, according to these authors, are in no way linked to the production of student outcomes). If all schools and districts suffer such inefficiencies, then one cannot possibly discern underlying minimum costs by studying those institutions. However, CHL’s argument rests on the assumption that desired outcomes could be achieved while spending substantially less and entirely differently than any existing school or district spends, all else being equal. As discussed throughout this report, evidence to this effect is sparse to nonexistent.

Authors of cost function research assert, however, that the goal of cost modeling is more modest than exact predictions of minimum cost, and that much can be learned by better understanding the distribution of spending and outcomes across existing schools and districts, and the varied efficiency with which existing schools and districts achieve

current outcomes.⁹⁷ That is, the goal of the cost model is to identify, among existing “outcome producing units” (districts or schools), the more (and less) efficient spending levels associated with given outcomes, where those more efficient spending levels associated with any given outcome provide a real-world approximation, approaching the minimum costs of achieving those outcomes.

CHL’s empirical critique of education cost function research centers on a falsification test, applying findings from a California study by Jennifer Imazeki (2008).⁹⁸ CHL’s critique was published in a non-peer-reviewed special issue of the *Peabody Journal of Education*, based on testimony provided in the state of Missouri and funded by the conservative Missouri-based Show-Me Institute.⁹⁹ The critique asserts that if, as it would appear conceptually, the cost function is merely the flip side of the production function, then the magnitude of the spending-to-outcomes relationship should be identical between the cost and production functions. But, in Imazeki’s attempt to reconcile cost and production functions using California data, the results differed dramatically. That is, if one uses a production function to identify the spending associated with certain outcome levels, and then the cost function, the results differ dramatically. CHL use this finding to assert the failure of cost functions as a method and, more generally, the uncertainty of the spending-to-outcomes relationship.

Duncombe and Yinger (2011), however, explain the fallacy of this falsification test, in a non-peer-reviewed special issue of the same journal.¹⁰⁰ They explain that while the cost and production functions are loosely flip sides of the same equation, they are not exactly such. Production models are estimated using some outcome measure as the dependent variable—that which is predicted by the equation. In an education production function studying the effect of spending on outcomes, the dependent variable is predicted as a function of (a) a measure of relevant per-pupil spending; (b) characteristics of the student population served; and (c) contextual factors that might affect the value of the dollar toward achieving outcomes (economies of scale, regional wage variation).

$$\text{Outcomes} = f(\text{Spending, Students, Context})$$

The cost model starts out similarly, switching the position of the spending and outcomes measures, and predicting spending levels as a function of outcomes, students and context factors.

$$\text{Spending} = f(\text{Outcomes, Students, Context})$$

If it was this simple, then one would expect the statistical relationship between outcomes and spending to be the same from one equation to the next. But there’s an addi-



tional piece to the cost function that, in fact, adds important precision to the estimation of the input to outcome relationship. The above equation is a spending function, whereas the cost function attempts to distill “cost” from spending by addressing the share of spending that may be “inefficient.” That is:

$$\text{Cost} = \text{Spending} - \text{Inefficiency, or} \\ \text{Spending} = \text{Cost} + \text{Inefficiency}$$

That is, some of the variation in spending is variation that does not lead to variations in the outcome measure. While we don’t really know exactly what the inefficiency is (which dollars are being spent in ways that don’t improve outcomes), Duncombe and Yinger suggest that we do know some of the indirect predictors of the likelihood that school districts spend more than would be needed to minimally achieve current outcomes, and that one can include in the cost model characteristics of districts that explain a portion of the inefficient spending. This can be done when the spending measure is the dependent variable, as in the cost function, but not when the spending variable is an independent measure, as in the production function.¹⁰¹

$$\text{Spending} = f(\text{Outcomes, Students, Context,} \\ \text{Inefficiency Factors})$$

When inefficiency factors are accounted for in the spending function, the relationship between outcomes and spending more accurately represents a relationship between outcomes and costs. This relationship would be expected to be different from the relationship between spending and outcomes (without addressing inefficiency) in a typical production function.

In summary, while education cost function research is not designed to test specifically whether and to what extent money matters, the sizeable body of cost function literature does suggest that achieving higher educational outcomes, all else being equal, costs more than achieving lower educational outcomes. Further, achieving common educational outcome goals in settings with concentrated child poverty, children for whom English is a second language and children with disabilities costs more than achieving those same outcome goals with less needy student populations. Cost models provide some insights into how much more money is required in different settings and with different children to achieve measured outcome goals. Such estimates are of particular interest in this period of time when more and more states are migrating toward common standards frameworks and common assessments but are still providing their schools and districts with vastly different resources. Cost modeling may provide insights into just how much more funding may be required for all children to have equal opportunity to achieve these common outcome goals.

Do charter schools prove money doesn’t matter?

Some argue that charter schools generally achieve more for less or the same funding than traditional public schools serving similar student populations, thus validating that money doesn’t matter for improving school quality.¹⁰² The core assumption is that charter schooling improves efficiency because the flexibility afforded through chartering permits charter schools to engage in more creative teacher compensation strategies and technological substitution, such as trading small class sizes for efficient use of technology through blended and online learning. Further, efficiency improvement yielded by charter innovations creates competitive pressure on traditional public schools to improve.¹⁰³ However, regarding productivity improvements from technological substitution, a recent review of charter school literature by Epple, Romano and Zimmer (2015) characterized online and cyber charter schools in particular as a “failed innovation, delivering markedly poorer achievement outcomes than traditional public schools” (p. 55).¹⁰⁴ That said, we do not know if these markedly poor achievement outcomes were achieved with markedly fewer resources, and thus, a break-even on efficiency.

The assertion of large efficiency gains through chartering is often built on poor and/or misestimation of the resources received and used by charter schools. Specifically, it is asserted that charter schools generally receive less funding than do traditional public schools and achieve the same or better outcomes, thus making them more efficient.¹⁰⁵ The first assertion, that charter schools receive less funding and spend less, is certainly not uniformly true.¹⁰⁶ Baker, Libby and Wiley (2015) explain that charter school spending varies substantially by context and by operator within context. Some charter operators, in some contexts, spend substantially more than both other charter schools and traditional public schools in the same context, while others spend much less. The second assertion, that charters systematically outperform traditional district schools is also suspect,¹⁰⁷ and the specific assertion that those which do spend much less perform similar to or better than traditional district schools stands largely untested.

A handful of studies identify significant positive achievement effects of schools from the Knowledge Is Power Program (KIPP) network, but this same research provides only weak, imprecise measures of the resources available in these schools.¹⁰⁸ Baker, Libby and Wiley (2012, 2015) indicate that KIPP schools in New York and Texas tend to spend substantially more than traditional district schools serving similar populations.¹⁰⁹ Similarly, Dobbie and Fryer (2011) declare that high standards and “no excuses” strategies of select charter school operators are more important than spending differences in producing improved student



outcomes.¹¹⁰ But spending measures in the study are poorly documented and incomplete. Baker, Libby and Wiley's (2012, 2015) review of financial documents and public data, applying model-based comparisons of school-site expenditures to schools serving similar student populations, reveals that many of the school operators involved in Dobbie and Fryer's study spent far more than similar district schools.¹¹¹ Baker, Libby and Wiley (2012) also explain that much of the additional spending among high-spending charter operators is allocated to maintaining smaller class sizes, providing longer school days and years, and paying more to teachers, holding experience and education levels constant, for working those additional hours. That is, the investments by charter operators follow traditional wisdom and are not especially innovative.¹¹²

Perhaps the strongest empirical evidence of charter school efficiency advantages comes from the work of Gronberg, Taylor and Jansen (2012) on Texas charter schools.¹¹³ The authors find that, generally, Texas "charter schools are able to produce educational outcomes at lower cost than traditional public schools—probably because they face fewer regulations—but are not systematically more efficient relative to their frontier than are traditional public schools" (p. 302).¹¹⁴ In other words, while the overall cost of charter schools is lower for comparable output, the variations in relative efficiency among Texas charter schools are substantial. Efficiency is neither uniformly nor consistently achieved.

Related work by these authors reveals that the lower overall expenses are largely a function of lower salaries and inexperienced staff (Taylor et al., 2011).¹¹⁵ That is, the difference in total staffing cost, and resulting difference in total instructional expense per pupil, was largely due to the reduced experience levels of teachers, resulting in part from the fact that many of the schools existed for fewer than 10 years (many fewer than five), in addition to high turnover among teachers in their first few years. That is, compensation was held lower not because of creative technological substitution or alternative compensation, but because of relative inexperience and high turnover among educators. Epple, Romano and Zimmer (2015) suggest that these patterns are similar across studies of charter school teachers.¹¹⁶ Thus, estimated efficiency gains, where they do exist, may rely on maintenance of high turnover and relatively inexperienced staff, a questionably scalable and sustainable option.

Put simply, research on the charter school sector in the aggregate tells us little about whether and to what extent money matters, or if money can be made to matter more or less than it currently does leveraged through traditional investments in public schooling. Some charter schools spend much more than both other charter schools and traditional public schools and appear to yield benefits to

students from that spending. Others spend less and do poorly, and still others spend less but do less poorly than expected (and are thus more efficient). Still, the variations in the charter school sector, and the variations across traditional public schools, may provide insights down the line in how to more effectively and efficiently leverage resources. By and large, charter schools that spend more appear to do so by providing competitive compensation for their teachers, offering longer school days and years, and maintaining smaller classes, while those that spend less do so by maintaining inexperienced staff and high turnover.

SUMMING UP THE EVIDENCE

This brings me to a summary of the evidence on whether money matters in education. Despite the relative consistency of empirical findings over time regarding (a) whether per-pupil spending itself is related to student outcomes; (b) whether spending-related resources, such as teacher wages and class sizes, are related to student outcomes; and (c) whether improving the adequacy and equity of school funding can have positive effects on student outcomes, a persistent cloud of doubt hangs over political deliberations on school funding. Here, I review briefly the sources of that doubt, relative to what we do know with some confidence as well as what we still have yet to figure out about money and student outcomes.

Main sources of doubt

The primary source of doubt to this day remains the above-mentioned Eric Hanushek finding in 1986 that "*there appears to be no strong or systematic relationship between school expenditures and student performance.*"¹¹⁷

This single quote, now divorced entirely from the soundly refuted analyses on which it was based, remains a mantra for those wishing to deny that increased funding for schools is a viable option for improving school quality. Add to this statement the occasional uninformative and inflammatory anecdote regarding urban district spending and student outcomes in places like Kansas City or New Jersey, or the frequently re-created graphs showing spending and achievement over the past few decades, and one has a rhetorical war against an otherwise overwhelming body of empirical evidence.¹¹⁸

While research evidence regarding the importance of funding and specific schooling resources for improving student outcomes has become clearer with time, Hanushek and a



handful of peers have become even more entrenched in their views, as reflected in recent public testimony. Rhetoric among detractors has continued to drift from the cloud of doubt to a rock of certainty. That is, certainty that money has little or no role in improving school quality, and that school finance reforms that infuse additional funds only lead to greater inefficiency, having little or no effect on either equity or adequacy of schooling. Notably, Hanushek asserts (now and then) that it's not that money doesn't matter at all, but rather that additional money doesn't matter on top of the already high levels of spending that currently exist across all U.S. schools.

To summarize, the current dogma of Hanushek includes the following core tenets:

1. Because schools already spend so much and do so with such great inefficiency, additional funding is unlikely to lead to improved student outcomes.
2. How money is used matters much more than how much money is spent.
3. Differences in the amount of money some schools have than others are inconsequential, since those with less may simply make smarter spending decisions.

According to the recent rhetoric of Hanushek, these principles are ironclad. In his own words, they are “conventional wisdom” on which “virtually all analysts” agree. They are “commonly believed,” “overall truth” and backed by an “enormous amount of scientific analysis,” “substantial econometric evidence” and “considerable prior research.” For example, in the winter of 2015, in the context of school funding litigation in New York state, Hanushek opined:

“An enormous amount of scientific analysis has focused on how spending and resources of schools relates to student outcomes. It is now commonly believed that spending on schools is not systematically related to student outcomes.”¹¹⁹

Yet, the enormous amount of scientific analysis to which Hanushek referred in his expert testimony was primarily referenced to a 2003 summary of much of his prior work from the 1980s, work which has been discredited on numerous occasions,¹²⁰ including by research produced in the last 12 years. Similarly, in the same context (*Maisto v. State of New York*), Hanushek proclaims:

“There has been substantial econometric evidence that supports this lack of relationship.”

Hanushek again backs his claims with the same short list of dated self-citation.¹²¹ In an even more recent attempt to rebut a new, major study finding positive effects of school finance reforms,¹²² Hanushek (2015) makes the following version of the same claim:

“Considerable prior research has failed to find a consistent relationship between school spending and student performance, making skepticism about such a relationship the conventional wisdom.”¹²³

This time, he anchored that claim only to his 2003 piece (by hyperlink to the “prior research” phrase) on the failure of input-based schooling policies,¹²⁴ choosing to ignore entirely the considerably larger body of more rigorous work I summarize in my 2012 review on the topic.

The extension of these claims that nearly everyone agrees there's no clear relationship between spending and student performance is the assertion that there is broad agreement that how money is spent matters far more than how much money is available. As phrased by Hanushek in the context of New York state school finance litigation:

“Virtually all analysts now realize that how money is spent is much more important than how much is spent.”¹²⁵

As with the prior declarations, this one is made with the exceedingly bold assertion that virtually all analysts agree on this point—without reference to any empirical evidence to that point (a seemingly gaping omission for a decidedly empirical claim about a supposedly empirical truth). Further, “how money is spent” is constrained by whether sufficient money is there to begin with. While common sense dictates that how money is spent clearly matters, thus making this part of the statement widely agreeable, this does not preclude the relevance of how much money is available to spend.

Perhaps most disconcerting is that Hanushek has recently extended this argument to declare that equity gaps in funding, or measures of them, aren't an important policy concern either. Specifically, Hanushek proclaims:

“It also underscores how calculations of equity gaps in spending, of costs needed to achieve equity, or of costs needed to obtain some level of student performance are vacuous, lacking any scientific basis” (p. 4).¹²⁶

Put differently, what Hanushek is opining by declaring calculations of equity gaps to be vacuous and lacking scientific basis is that it matters not whether one school or district has more resources than another. Regardless of any spending differences, schools and districts can provide equitable education—toward equitable outcome goals. Those with substantively fewer resources simply need to be more efficient. Since all public schools and districts are presently so inefficient, achieving these efficiency gains through more creative personnel policies, such as performance-based pay and dismissal of “bad teachers,” is easily attainable.

Of course, even if we assume that creative personnel policies yield marginal improvements to efficiency, if schools with varied levels of resources pursued these strategies



with comparable efficiency gains, inequities would remain constant. Requiring those with less to simply be more efficient with what they have is an inequitable requirement. This argument is often linked in popular media and the blogosphere with the popular book and film *Moneyball*, which asserts that clever statistical analysis for selecting high-productivity, undervalued players was the basis for the (short-lived) success in 2002 and 2003 of the low-payroll Oakland Athletics baseball team. The flaws of this analogy are too many to explore thoroughly herein, but the biggest flaw is illustrated by the oft-ignored subtitle of the book: *The Art of Winning an Unfair Game*. That is, gaining a leg up through clever player selection is necessary in baseball because vast wealth and payroll differences across teams make baseball an unfair game. The public's interest in providing equitable and adequate funding for education is likely greater than ensuring equitable and adequate baseball payrolls. Put more bluntly, the education of present and future generations should not be an unfair game.

From judges to scholars, critics of Hanushek have characterized his evidence as “facile,” based on “fuzzy logic,”¹²⁷ and “weak and factually tenuous.”¹²⁸ Two recurring examples used by Hanushek to illustrate the unimportance of funding increases for improving outcomes are the “long-term trend” or “time trend” argument and anecdotal claims of the failures of input-based reforms in New Jersey. Baker and Welner (2011) tackle in depth the fallacies of Hanushek's New Jersey claims.¹²⁹ Here, I point to Hanushek's own, albeit facile, unacknowledged self-debunking of his New Jersey claims. But first, I address the long-term trend claim.

Again, from recent testimony in New York state, Hanushek provides the following exposition of the long-term trend assertion:

“The overall truth of this disconnect of spending and outcomes is easiest to see by looking at the aggregate data for the United States over the past half century. Since 1960, pupil-teacher ratios fell by one-third, teachers with master's degrees over doubled, and median teacher experience grew significantly (Chart 1).⁴ Since these three factors are the most important determinants of spending per pupil, it leads to the quadrupling of spending between 1960 and 2009 (after adjusting for inflation). At the same time, plotting scores for math and reading performance of 17-year-olds on the National Assessment of Educational Progress (NAEP, or “The Nation's Report Card”) shows virtually no change since 1970 (Charts 2 and 3).^{5”}¹³⁰

This claim, like many of Hanushek's, is made with language of astounding certainty—the “overall truth” as it exists in the mind of Hanushek. This claim is commonly accompanied by graphs showing per-pupil spending going up over time, pupil-to-teacher ratios going down and national

assessment scores appearing relatively flat, much of which is achieved via the smoke and mirrors of representing spending and outcome data on completely different scales, and via the failure to adjust appropriately for the changing costs and related obligations of the public education system and for the changing demography of the tested population.¹³¹ Oversimplified visuals are used to make the proclamation that student achievement shows “virtually no change,” a statement discredited on closer inspection.¹³² Jackson, Johnson and Persico (2015) provide additional examples of how such facile analyses lead to fallacious conclusions.¹³³

As explained by Baker and Welner (2011),¹³⁴ Hanushek for years has cited the failures of New Jersey's school finance reforms as the basis for why other states should not increase funding to high-poverty schools. In litigation in Kansas in 2011, Hanushek proclaimed:

“The dramatic spending increases called for by the courts (exhibit 34) have had little to no impacts on achievement. Compared to the rest of the nation, performance in New Jersey has not increased across most grades and racial groups (exhibits 35-40). These results suggest caution in considering the ability of courts to improve educational outcomes.”¹³⁵

Hanushek reiterated these claims in the context of an even more recent New York school funding challenge.¹³⁶ This is a surprising claim to preserve when one's own recent (2012), marginally more rigorous analyses of state achievement growth rates on national assessments (from 1992 to 2011)¹³⁷ find the following:

“The other seven states that rank among the top-10 improvers, all of which outpaced the United States as a whole, are Massachusetts, Louisiana, South Carolina, New Jersey, Kentucky, Arkansas, and Virginia.”¹³⁸

Further, the same report reveals that New Jersey has seen particularly strong growth in reducing the number of the lowest-performing students (those scoring at the “below basic” level), especially for eighth-grade math.

To be sure, there are others in academe and policy research that raise questions about the most effective ways to leverage school funding to achieve desired outcomes, and do so via more rigorous, thoughtful analyses. The most recent rigorous and relevant academic research is addressed in the remainder of this brief. There are others who opine in the public square¹³⁹ and courtroom¹⁴⁰ that school finance reform—specifically infusing additional funding to districts serving high-need student populations—is neither the most effective nor the most efficient path toward improving schooling equity or adequacy. But empirical evidence to support claims of more efficient alternatives remains elusive.

No rigorous empirical study of which I am aware validates that increased funding for schools in general, or targeted to



specific populations, has led to any substantive, measured reduction in student outcomes or other “harm.” Arguably, if this were the case, it would open new doors to school finance litigation against states that choose to increase funding to schools. Twenty years ago, economist Richard Murnane summarized the issue exceptionally well when he stated:

“In my view, it is simply indefensible to use the results of quantitative studies of the relationship between school resources and student achievement as a basis for concluding that additional funds cannot help public school districts. Equally disturbing is the claim that the removal of funds ... typically does no harm” (p. 457).¹⁴¹

Murnane’s quote is as relevant today as it was then. The sources of doubt on the “Does money matter?” question are not credible.

While there remains much to debate, discuss and empirically evaluate regarding the returns to each additional dollar spent in schools—and the strategies for improving educational efficiency, equity and adequacy—we must finally be willing to cast aside the most inane arguments and sources of evidence on either side of the debate. Specifically, the following five contentions no longer have a legitimate place in the debate over state school finance policy and whether and how money matters in K-12 education:

1. Vote counts of correlational studies between spending and outcomes, without regard for rigor of the analyses and quality of the data on which they depend;
2. The long-term trend argument and supporting graphs that show long-term spending going up and NAEP scores staying flat;
3. International comparisons asserting, and perhaps illustrating via scatterplot, that the United States spends more than other developed countries but achieves less on international assessments;
4. Anecdotal assertions that states such as New Jersey and cities such as Kansas City provide proof positive that massive infusions of funding have proven ineffective at improving student outcomes; and
5. The assertion that how money is spent is much more important than how much is available.

Vote count tallies without regard for study quality and rigor are of relative little use for understanding whether money matters in schooling and are of no use for discerning how. The long-term trend argument is perhaps the most reiterated of all arguments that money doesn’t matter, but it is built largely on deceptive, oversimplified and largely wrong

characterizations (accompanied by distorted visuals) of the long-term trends in student outcomes and school spending. Facile international comparisons are equally deceitful, in that they (a) fail to account for differences in student populations served and the related scope of educational and related services provided; and (b) fail to appropriately equate educational spending across nations, including the failure to account for the range of services and operating costs covered under “educational expense” in the United States versus other countries (for example, public employee health and pension benefits). And anecdotal assertions of failures resulting from massive infusions of funding are rebutted herein and elsewhere.¹⁴²

Finally, while the assertion that “how money is spent is important” is certainly valid, one cannot reasonably make the leap to assert that how money is spent is necessarily more important than how much money is available. Yes, how money is spent matters, but if you don’t have it, you can’t spend it. It is unhelpful at best for public policy, and harmful to the children subjected to those policies, to pretend without any compelling evidence that somewhere out there exists a far cheaper way to achieve the same or better outcomes (and thus we can cut our way down that more efficient path). As so eloquently noted by a three-judge panel in Kansas when faced with this question:

“Simply, school opportunities do not repeat themselves and when the opportunity for a formal education passes, then for most, it is most likely gone. We all know that the struggle for an income very often—too often—overcomes the time needed to prepare intellectually for a better one.

“If the position advanced here is the State’s full position, it is experimenting with our children which have no recourse from a failure of the experiment.”¹⁴³

What do we know?

Based on the studies reviewed in this brief, there are a few things we can say with confidence about the relationship between funding, resources and student outcomes.

First, on average, even in large-scale studies across multiple contexts, aggregate measures of per-pupil spending are positively associated with improved and/or higher student outcomes. In some studies, the size of this effect is larger than in others, and, in some cases, additional funding appears to matter more for some students than for others. Clearly, there are other factors that moderate the influence of funding on student outcomes, such as how that money is spent. But, on balance, in direct tests of the relationship between financial resources and student outcomes, money matters.



Second, schooling resources that cost money, including class size reductions and increased teacher compensation, are positively associated with student outcomes. Again, these effects are larger in some cases and for some populations. On balance, though, there are ways to spend money that have a solid track record of success. Further, while there may exist alternative uses of financial resources that yield comparable or better returns in student outcomes, no clear evidence identifies what these alternatives might be.

Third, sustained improvements to the level and distribution of funding across local public school districts can lead to improvements in the level and distribution of student outcomes. While money alone may not be the answer, adequate and equitable distributions of financial inputs to schooling provide a necessary underlying condition for improving the adequacy and equity of outcomes. That is, if the money isn't there, schools and districts simply don't have a "leverage option" that can support strategies that might improve student outcomes. If the money is there, they can use it productively; if it's not, they can't. But, even if they have the money, there's no guarantee that they will use it productively. Evidence from Massachusetts, in particular, suggests that appropriate combinations of more funding with more accountability may be most promising.

What don't we know?

Indeed, there are many unanswered questions about how money matters and how it can matter most. Specifically, while many talk of more efficient or cost-effective options for spending money, information on these options is sorely lacking. Rhetoric abounds regarding current approaches to public schooling—such as spending on class size reduction—being the most inefficient or least cost-effective options. But proposed alternatives, such as restructuring teacher pay around indicators of "effectiveness" rather than seniority or credentials, are not backed by solid research and include no serious evaluations of cost. Accordingly, they provide no legitimate basis for comparing cost-effectiveness.

While we do have evidence that increased salaries may improve the quality of the teacher workforce and student outcomes, we do not have sufficient evidence to determine whether the same dollar spent on salaries to "improve teacher quality" by some (often unstated) means would achieve better or worse outcomes than if that dollar was spent on a more proven intervention, such as class size reductions. Moreover, even if there were evidence that some new policy was more cost-effective, this would actu-

ally represent an argument that money matters, not the opposite.

There is also limited evidence about the connection between funding and *longer-term* outcomes. In an era where educational output and outcomes are increasingly measured in terms of short-term changes in students' performance on standardized tests of reading and math, we have arguably lost sight of broader and/or intermediate- and long-term outcomes. We need to know more about the relationship between access to resources in preschool, elementary school and secondary school and successful transitions to and completion of undergraduate education (and labor market outcomes). We do have a growing body of evidence that students' access to advanced coursework in mathematics does have a positive relationship to undergraduate success, and that access to a breadth of curricular and co-curricular opportunities increases college access.¹⁴⁴ And we know that such opportunities are inequitably distributed across children.¹⁴⁵ This research must expand to include a broader array of both inputs and outputs.

The primary problem is that state data systems provide limited capacity to track students from K-12 systems through college and into the workforce. Moreover, while the precision of financial data is improving in some regards, it remains difficult to tie district-level expenditure data to specific schools, programs and classrooms, limiting the ability of researchers to explore more closely the relationship between spending patterns, resource allocation choices and student outcomes. Hopefully, states will improve the quality and scope of their available data in the near future.

CONCLUDING THOUGHTS

Given the preponderance of evidence that resources do matter and that state school finance reforms can effect changes in student outcomes, it seems somewhat surprising that not only has doubt persisted, but the rhetoric of doubt seems to have escalated. In many cases, direct assertions are made that schools can do more with less money; that money is not a necessary underlying condition for school improvement; and, in the most extreme cases, that cuts to funding might actually stimulate improvements that past funding increases have failed to accomplish.

To be blunt, money does matter. Schools and districts with more money clearly have a greater ability to provide higher-quality, broader and deeper educational opportunities to the children they serve. Furthermore, in the absence of money, or in the aftermath of deep cuts to existing funding, schools are unable to do many of the things they need to



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Matter in
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do in order to maintain quality educational opportunities. Without funding, efficiency tradeoffs (like focusing on teacher quality versus teacher quantity) and innovations (like online learning) being broadly endorsed are suspect. One cannot trade spending money on class size reductions to increase teacher salaries to improve teacher quality if funding is not there for either—if class sizes are already large and teacher salaries noncompetitive. While these are not the conditions faced by all districts, they are faced by many.

It is certainly reasonable to acknowledge that providing more money, by itself, is not a comprehensive solution for improving school quality. Clearly, money can be spent poorly and have limited influence on school quality. On the flip side, money can be spent well and have substantive positive influence. *However, money that's not there can't do either.* The available evidence leaves little doubt: Sufficient financial resources are a necessary underlying condition for providing quality education.



Appendix: Methods and Measures in Money Matters Questions

Measuring the inputs

In this appendix, in order to help readers better understand the methods used in the studies discussed in this paper, I provide a more detailed primer on studying the relationship between money and student outcomes.

Broadly, studies of the “Does money matter?” genre seek to determine whether differences or changes in access to schooling inputs are associated with or result in differences in or changes to student outcomes. Any such studies must therefore include some measures of schooling inputs and of student outcomes. In studies that might fall into the “Does money matter?” category, input measures include money itself and resources that cost money.

Money itself

Per-pupil expenditure is a commonly used measure of the aggregate level of financial resources available in public school districts. The measure typically includes all current operating expenditures of school districts—that is, the fiscal year spending on salaries and benefits for school employees, on classroom supplies and equipment, and on facility utilities, maintenance and operations—divided by the number of children served. But this measure is problematic on a number of levels. First, very few studies appropriately adjust the value of per-pupil spending for differences (such as levels of labor competition or other costs) across labor markets within states.¹⁴⁶ Second, some substantive differences in school district offerings that do cost money don’t show up as per-pupil expenditure variation, such as the addition of prekindergarten programs, which adds both spending and students, often at lower per-pupil spending than occurs in upper grades. It is a substantive addition to the educational program that may, in some cases, reduce average per-pupil spending districtwide.

Components of per-pupil spending, such as “instructional spending” or “administrative spending,” are also occasionally explored for their differential effects (if any) on student outcomes.¹⁴⁷ It is often presumed that instructional spending differences will be most related to student outcomes (where instructional spending is often described as “money to the classroom,” consisting of teacher wages, materials, supplies, equipment and classroom support staff).

Resources that cost money

Differences in school- and district-level instructional spending often boil down to differences in quantities of instructional staff and differences in the characteristics of those staff (most related to differences in salaries related to differences in years of experience and degree levels). Quantities of instructional staff are most often measured in terms of class sizes or pupil-to-teacher ratios. To the extent that having a greater quantity of teachers affects student outcomes, then so too does having the money available to increase the quantity of teachers.

Teacher experience and degree levels are also often studied in the context of the “Does money matter?” debate because, within traditional teacher salary schedules, teachers with more experience and with more advanced degrees are generally paid higher salaries. To the extent that these characteristics are associated with differences in student outcomes, expenditures on these characteristics may be assumed to be associated with student outcomes.

One might also look specifically at comprehensive school reform models, some of which are noted for their resource intensiveness, such as the Roots and Wings/Success for All model¹⁴⁸ and the more recently touted Apollo 20 program in Houston.¹⁴⁹ To the extent that these models require greater expenditure than current levels, and result in better outcomes than current levels, a reasonable argument can be made that money spent on these reforms matters. Many comprehensive reform strategies embed some degree of additional staffing (instructional quantity) with some degree of professional development (improving instructional quality), and the relative costs of these components may be distilled.

Measuring the outcomes

Equally pertinent is the measurement of outcomes. Outcome measures in “Does money matter?” or “Does school quality matter?” studies tend to take three forms: short-term and concurrent academic achievement measures, mid-term academic attainment measures, and long-term economic benefit measures.

Short-term and concurrent academic achievement measures are the most common in the past two decades because of the increased availability of individual student-level data on academic achievement, largely from state data systems implemented for accountability purposes but also

from large national surveys, including the National Education Longitudinal Study of the eighth-grade class of 1988. Typically, when longitudinal data are available on individual students on measures of academic achievement, the goal is to determine the influence of differential school resources as a treatment on gains in student achievement outcomes. Most commonly, the measured outcomes are for math and language arts.

Mid-term academic attainment measures include measures of high school graduation rates, transition to higher education, persistence in higher education (and completion of specific coursework and credits) and time to completion of postsecondary education. These intermediate measures of attainment are less common, perhaps due to the relatively limited availability of detailed individual-level data linking K-12 education system parameters and college attendance patterns of graduates of specific K-12 schools and districts.

Long-term economic benefit measures have been the focus of numerous large-scale economic studies of the influence of schooling quality. From an economic perspective, there is great interest in validating that measurable differences in school quality or investment in schooling can ultimately have measurable effects on both individual wages and the economy as a whole.

Research methods for linking the two

A handful of research methods and statistical approaches have been used to evaluate the connection between money and schooling resources and student outcomes. These methods may be broadly classified into those that involve studying the “natural variation” in schooling quality available to individuals, based on where they attend school, and studies that involve the random assignment of students to receive specific reforms, strategies or programs (with fiscal implications). Note that natural variation is a research euphemism for the vast systemic inequity of the American public education system. Studies of natural variation may explore differences across schooling contexts or changes in schooling quality over time, which are in effect policy-induced variations.

Studies relying on natural variation

Most studies exploring the relationship between existing differences in schooling resources and existing differences in student outcomes attempt to estimate some form of a statistical model that relates student outcomes to financial or other schooling inputs, given background characteristics on student populations

served and contextual factors of schools and districts in which those students are served. When framed this way, the statistical models are “production function” models, or models of the production of student outcomes.¹⁵⁰ These studies seek to identify whether there exists a statistically significant relationship between spending measures or other school resource measures and student outcomes, ideally measured at the individual student level and measured in terms of outcome gains. Further, even if statistically significant, it is important to know how differences in inputs are associated with differences in outcomes. For example, how many more dollars does it take to improve achievement by a specific amount?

Numerous technical issues complicate these analyses, such as problems with fully accounting for “unobservable” differences in student backgrounds or schooling contexts, and difficulties determining what the right “shape” of the statistical relationship is between inputs and outcomes (for example, to what extent are there diminishing returns and when do they kick in?), each of which may compromise the validity of findings.¹⁵¹

Another type of model, not often discussed as a method for determining whether money matters, is the education cost function.¹⁵² The education cost function essentially turns the education production function around in an attempt to determine the costs per pupil of achieving desired educational outcome levels, given the student populations served and contextual factors such as differences in the prices of schooling inputs, economies of scale, population sparsity and remoteness. In effect, these studies attempt to determine whether it costs more to achieve more, and how much it costs to do so, given the average costs of existing practices of schooling.¹⁵³ In other words, does money matter?

Related studies of existing or historical variation of resources across children have explored the relationship between changes in the distribution or overall level of funding allocated by states to local public schools or districts and resulting changes in the level or distribution of student outcomes. For example, if a state allocates substantially more resources than in the past to low-wealth school districts, do student outcomes in those districts improve? These are policy-induced variations or changes, but are not experiments. I refer to these studies as “Do school finance reforms matter?” studies, and they are a particularly relevant variation on the broader “Does money matter?” question. They are important because state school finance policy is the primary vehicle for changing the level or distribution of funds available to schools and districts, and for altering in substantive ways the natural variation (inequity) of the system.

Studies relying on experiments

Finally, there are those studies that rely on what is considered the gold standard for research and evaluation of educational programs—experimental design studies. Experimental design studies randomly assign one group of students to receive a specific set of programs and services and another group of students to a control group, or one that does not receive the treatment of interest. Large-scale experimental design studies have been conducted to determine the effects of class size reduction on student outcomes, participation in preschool programs on student outcomes, and the

implementation of specific comprehensive school reform models¹⁵⁴ on student outcomes. Randomized trials are useful for studying specific reforms or models that may have cost implications, but, to the best of my knowledge, randomized trials have not been conducted to discern the importance of financial inputs to schooling directly, in part because doing so would severely deprive some students of resources, which would likely be objectionable to institutional review boards and the general citizenry. Though, arguably, permitting the persistence of extreme natural variations is no less objectionable.

Endnotes

- 1 For a comprehensive review of research on the effectiveness of early childhood education programs, see W. S. Barnett, "Effectiveness of Early Educational Intervention," *Science* 333, no. 6045 (2011): 975-978.
- 2 http://nces.ed.gov/programs/digest/d06/tables/dt06_061.asp.
- 3 For a version of this argument, see www.huffingtonpost.com/bill-gates/bill-gates-school-performance_b_829771.html. However, most characterizations of the extent of national average spending increase are grossly oversimplified. Further, on average, student achievement on the National Assessment of Educational Progress has actually improved quite dramatically over time and achievement gaps have narrowed. For example, adjusting spending growth only for traditional inflation measures, which account for changes in the prices of consumer goods, does not account for (a) changes in competitive wages of nonteachers, which influence the ability of schools to recruit and retain teachers and have far outpaced the consumer price index; (b) changes in the range and level of outcomes desired of our students, which affect costs significantly; and (c) changes in the demographics of the student population, which affect the cost of achieving outcome objectives. See www.epi.org/publication/fact-challenged_policy and www.ets.org/Media/Research/pdf/PICBWGAP.pdf.
- 4 http://blogs.orlandosentinel.com/news_politics/2011/10/scott-anthropology-and-journalism-dont-pay-and-neither-do-capes.html.
- 5 <http://www.governor.ny.gov/sl2/stateofthestate2011transcript>.
- 6 <http://blogs.wsj.com/metropolis/2014/02/11/cuomo-on-education-funding-lawsuit-it-aint-about-the-money>.
- 7 <http://online.wsj.com/article/SB10001424052702303348504575184120546772244.html>.
- 8 <http://thinkprogress.org/education/2015/02/13/3623158/brat-education-plato>.
- 9 B. D. Baker, "Evaluating the Recession's Impact on State School Finance Systems," *Education Policy Analysis Archives* 22, no. 91 (2014), <http://dx.doi.org/10.14507/epaa.v22n91.2014>.
- 10 M. Leachman and C. Mai, *Most States Still Funding Schools Less Than Before the Recession*, Center on Budget and Policy Priorities, October 16, 2014, www.cbpp.org/research/most-states-still-funding-schools-less-than-before-the-recession.
- 11 V. Bandeira de Mello, G. Bohrstedt, C. Blankenship and D. Sherman, *Mapping State Proficiency Standards onto NAEP Scales: Results from the 2013 NAEP Reading and Mathematics Assessments* (NCES 2015-046) (Washington, DC: National Center for Education Statistics, 2015), <http://nces.ed.gov/pubsearch>.
- 12 Baker and Welner explain how the U.S. Department of Education has recently established a website on improving educational productivity, with specific intent to inform state policy and local practice. But, as Baker and Welner note: "None of the materials listed or recommendations expressed within those materials are backed by substantive analyses of the cost effectiveness or efficiency of public schools, of practices within public schools, of broader policies pertaining to public schools, or of resource allocation

strategies. Instead, the sources listed on the site's 'resources' page are speculative think tank reports and related documents that do not include or even cite the types of analyses that would need to be conducted to arrive at their conclusions and policy recommendations." B. D. Baker and K. G. Welner, *Evidence and Rigor: A Call for the U.S. Department of Education to Embrace High Quality Research* (National Education Policy Center, 2011).

- 13** The scope of this review is limited to domestic studies. The emphasis of the review is on major peer-reviewed studies in each of the three categories listed. Further, the emphasis is on studies that use data aggregated to no higher level than local public school districts. That is, no cross-state or cross-national aggregate analyses are emphasized, though some are listed to point out their existence. For the older production function literature, the bulk of the discussion herein focuses on major meta-analyses published in the late 1980s to late 1990s, which reviewed studies from prior years. I do not reinvestigate those prior studies but do refer to some throughout. This review contains only a selected summary of major works on topics such as class size and teacher characteristics that have financial implications. For studies of state school finance reforms to be included, the studies must measure more than the mere presence or nominal indication that reform happened. Further, studies are addressed if they attempt to measure the relationship between changes in the level of financial resources for students in particular settings (districts, schools) and subsequent changes in the level of outcomes, or changes in the distribution of schooling resources and distribution of student outcomes. Only studies using short-term academic outcomes (measured achievement, aptitude and graduation rates) are included. Preference is given to peer-reviewed studies and studies attempting to validate statistically a link between changes in the level or distribution of funding and the level or distribution of outcomes.
- 14** J. S. Coleman, E. Q. Campbell, C. F. Hobson, J. McPartland, A. M. Mood, et al., *Equality of Educational Opportunity* (Washington, DC: U.S. Office of Education, 1966).
- 15** For an early discussion of the Coleman findings and misinterpretations of those findings with respect to policy implications, see G. C. Kain and H. W. Watts, "Problems in Making Policy Inferences from the Coleman Report," *American Sociological Review* 35, no. 2 (1970): 228-242; and S. Bowles and H. M. Levin, "The Determinants of Scholastic Achievement—an Appraisal of Some Recent Evidence," *Journal of Human Resources* 3, no. 1 (1968): 24.
- 16** S. Konstantopolous and G. Borman, "Family Background and School Effects on Student Achievement: A Multilevel Analysis of the Coleman Data," *Teachers College Record* 113, no. 1 (2011): 97-132.
- 17** G. D. Borman and M. Dowling, "Schools and Inequality: A Multilevel Analysis of Coleman's Equality of Educational Opportunity Data," *Teachers College Record* 112, no. 5 (2010): 1201-1246.
- 18** D. Card and A. Krueger, "Does School Quality Matter? Returns to Education and the Characteristics of Schools in the United States," *Journal of Political Economy* 100, no. 1 (1992): 1-40. In a paper from a few years later, Card and Krueger present a more tentative position on whether schooling resources are clearly linked to earnings and attainment, a more specific question. They note: "Does the literature on school resources, earnings and educational attainment prove beyond a reasonable doubt that resources matter? We do not believe that the evidence justifies so strong a conclusion. The available evidence is not unambiguous or ubiquitous, and it suffers from all the standard criticisms of drawing causal inferences from observational data." See D. Card and A. Krueger, "School Resources and Student Outcomes: An Overview of the Literature and New Evidence from North and South Carolina," *Journal of Economic Perspectives* 10, no. 4 (1996): 31-50.
- 19** J. Betts, "Is There a Link between School Inputs and Earnings? Fresh Scrutiny of an Old Literature," in Gary Burtless, ed., *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success* (Washington, DC: Brookings Institution, 1996), 141-191.
- 20** A later article by Hanushek, reiterating and updating his earlier findings, also shows up as widely cited in the Social Science Citation Index: E. A. Hanushek, "Assessing the Effects of School Resources on Student Performance: An Update," *Educational Evaluation and Policy Analysis* 19, no. 2 (1997): 141-164.
- 21** E. A. Hanushek, "Economics of Schooling: Production and Efficiency in Public Schools," *Journal of Economic Literature* 24, no. 3 (1986): 1141-1177. A few years later, Hanushek paraphrased this conclusion in another widely cited article as "Variations in school expenditures are not systematically related to variations in student performance." E. A. Hanushek, "The Impact of Differential Expenditures on School Performance," *Educational Researcher* 18, no. 4 (1989): 45-62. Hanushek describes the collection of studies relating spending and outcomes as follows: "The studies are almost evenly divided

between studies of individual student performance and aggregate performance in schools or districts. Ninety-six of the 147 studies measure output by score on some standardized test. Approximately 40 percent are based upon variations in performance within single districts while the remainder look across districts. Three-fifths look at secondary performance (grades 7-12) with the rest concentrating on elementary student performance" (fn #25).

- 22** Greenwald and colleagues explain: "Studies in the universe Hanushek (1989) constructed were assessed for quality. Of the 38 studies, 9 were discarded due to weaknesses identified in the decision rules for inclusion described below. While the remaining 29 studies were retained, many equations and coefficients failed to satisfy the decision rules we employed. Thus, while more than three quarters of the studies were retained, the number of coefficients from Hanushek's universe was reduced by two thirds" (p. 363). Greenwald and colleagues further explain that: "Hanushek's synthesis method, vote counting, consists of categorizing, by significance and direction, the relationships between school resource inputs and student outcomes (including but not limited to achievement). Unfortunately, vote-counting is known to be a rather insensitive procedure for summarizing results. It is now rarely used in areas of empirical research where sophisticated synthesis of research is expected" (p. 362).

Hanushek (1997) provides his rebuttal to some of these arguments, and Hanushek returns to his "uncertainty" position: "The close to 400 studies of student achievement demonstrate that there is not a strong or consistent relationship between student performance and school resources, at least after variations in family inputs are taken into account" (p. 141). E. A. Hanushek, "Assessing the Effects of School Resources on Student Performance: An Update," *Educational Evaluation and Policy Analysis* 19, no. 2 (1997): 141-164. See also E. A. Hanushek, "Money Might Matter Somewhere: A Response to Hedges, Laine and Greenwald," *Educational Researcher* 23 (May 1994): 5-8.

- 23** R. Greenwald, L. Hedges and R. Laine, "The Effect of School Resources on Student Achievement," *Review of Educational Research* 66, no. 3 (1996): 361-396.
- 24** H. Wenglinsky, "How Money Matters: The Effect of School District Spending on Academic Achievement," *Sociology of Education* 70, no. 3 (1997): 221-237.
- 25** C. Taylor. "Does Money Matter? An Empirical Study Introducing Resource Costs and Student Needs into Educational Production Function Analysis," in

Developments in School Finance, 1997, ed. W. J. Fowler Jr. (Washington, DC: U.S. Department of Education, National Center for Education Statistics, 1998), <http://nces.ed.gov/pubs98/98212.pdf#page=83>.

- 26** B. D. Baker, "Can Flexible Non-Linear Modeling Tell Us Anything New about Educational Productivity?," *Economics of Education Review* 20, no. 1 (2001): 81-92; D. N. Figlio, "Functional Form and the Estimated Effects of School Resources," *Economics of Education Review* 18, no. 2 (1999): 242-252; and J. Dewey, T. Husted and L. Kenny, "The Ineffectiveness of School Inputs: A Product of Misspecification," *Economics of Education Review* 19, no. 1 (2000): 27-45.
- 27** Specifically, Dewey and colleagues explain that many previous studies attempting to distill school resource effects on student outcomes concurrently correct for the economic background of students. However, the economic background measures, such as family income, are also strong determinants of the demand for schooling resources. Thus, including the two simultaneously in regression models violates both conceptual appropriateness (resource levels are endogenous to family characteristics) and statistical properties associated with those conceptual problems (that the error term is correlated with the school input measures, requiring a different statistical approach). Dewey and colleagues review the previous studies summarized by Hanushek, identifying that several suffer from this problem and that those that do tend to understate the influence of resources. Then Dewey and colleagues estimate alternative production functions.

We conducted our own empirical analysis using the Project TALENT student-level data set from 1960 and pooled state data for 1987-1992. In regressions from both data sets that were not plagued by misspecification, there is evidence that each school input had an impact on achievement (p. 42). Figlio's study of alternative specifications of the "shape" of the relationship between money and outcomes raises similar issues about previous literature, including studies summarized by Hanushek, as does Corrine Taylor's analysis that applies adjustments for the costs of hiring teachers. Indeed, many of the same studies considered rigorous enough for inclusion in Greenwald and colleagues analyses also suffer from the problems addressed by Husted and Kenny, and by Taylor (geographic cost adjustment) and Figlio. But, note that in each case, Dewey and colleagues, Taylor and Figlio find that when applying functional form and labor cost corrections, they tend to find stronger effects of schooling resources—specifically

money. So, one might then argue that Greenwald and colleagues' decisively positive findings are, in fact, understated. In conducting this review, I went back to a handful of the original studies summarized by Hanushek (1986) and listed in the sources note to Table 8 of that article. Several were not easily accessible, having been non-peer-reviewed reports and doctoral theses. But among those available, consistent with the findings of Husted and Kenny, none attempted to account for the endogeneity of expenditures, often either evaluating simple correlations between spending and outcome measures (thus suffering significant omitted variables bias) or including a spending measure alongside determinants of spending. Arguably, teacher characteristics, including teacher salaries, are also endogenous to local demand factors. Original Hanushek studies reviewed include:

A. Boardman, O. Davis and P. Sanday, "A Simultaneous Equations Model of the Educational Process," *Journal of Public Economics* 7, no. 1 (1977): 23-49. This study does not explore expenditures directly but does include measures of schooling facilities and teacher characteristics, but not salary. Thus, regional cost variation is less (or not) for the value of teacher salaries or education spending is less at issue. The authors of this study find that "many educational outputs jointly determine one another. Also, the results suggest that school and teacher variables have important effects on educational outcomes" (p. 23).

G. E. Johnson and F. P. Stafford, "Social Returns to Quantity and Quality of Schooling," *Journal of Human Resources* 8, no. 2 (1973): 139-155. In this study, the authors find "high but diminishing marginal returns to investment in expenditures per pupil per year" (p. 139). This is among the studies that arguably understates the sensitivity of expenditures to outcomes by inclusion of the spending measure (natural log of expenditures) in the model with determinants of expenditure (family socioeconomic status). In addition, the model uses a national sample but fails to control for regional variation in the value of expenditures.

C. R. Link and E. C. Ratledge, "Social Returns to Quantity and Quality of Education: A Further Statement," *Journal of Human Resources* 10, no. 1 (1975): 78-89. Link and Ratledge find: "Large but diminishing returns to incremental expenditures are observed" (p. 78). Link and Ratledge also use national survey data (National Longitudinal Study of the Labor Force). For the expenditure measure, like the above study, they use a measure of the 1968 district level per-pupil expenditures (natural logarithm) and also do not correct for regional variation, though some of the urbanicity variables included may capture a portion of this variation

(unintentionally). The endogeneity problems are less clear in this study, because in place of controlling for direct demand determinants (family income, education), the authors control for individual IQ. However, IQ is arguably simultaneously determined with education spending, both IQ and school spending being a function of parental economic status and education level. Sensitive to this point, the authors explore direct and indirect effects of IQ, years of education and expenditures.

R. Raymond, "Determinants of the Quality of Primary and Secondary Public Education in West Virginia," *Journal of Human Resources* 3, no. 4 (1968): 450-470. Raymond studied 5,000 students in West Virginia. Raymond did not explore per-pupil expenditures but did explore several teacher salary measures, but does not correct for regional variation in the value of those salaries across West Virginia. Raymond finds salaries to be associated with output measures of quality.

T. I. Ribich and J. L. Murphy, "The Economic Returns to Increased Educational Spending," *Journal of Human Resources* 10, no. 1 (1975): 56-77. Ribich and Murphy used data from the national Project Talent survey. Ribich and Murphy found: "School expenditures are found to influence how many years of schooling an individual eventually receives, and the chief effect of spending differences on lifetime income is found to work through this school continuation link" (p. 56). Ribich and Murphy partly (though far from completely) correct for regional differences in the value of expenditures by including region variables. But, regression estimates likely suffer endogeneity addressed by Dewey, Husted and Kenny (including both family socioeconomic measures and expenditures alongside one another). Interestingly, the authors instead attribute the insensitivity of their outcome measures to spending (when directly estimated including all regions) to regional differences, specifically racial differences within southern states.

F. Welch, "Measurement of the Quality of Schooling," *American Economic Review* 56 (1966): 379-392. This study explored the return to elementary and secondary schooling of the male rural farm population in 1959, focusing on those who had not attended college in an effort to isolate differences in elementary and secondary schooling quality. This study is problematic on a number of levels when viewed in hindsight. First, the ultimate analysis of factors associated with the quality of schooling is aggregated to the state level (and noted by the author as a significant limitation). Second, expenditure measures are included in models with (a) potential determinants of expenditures (racial composition, labor composition, enrollment per secondary school); and (b) schooling resources

dependent on expenditures (salaries, staff per 100 pupils) (see regression output in Table 4, p. 390). Further, expenditures are not adjusted for regional differences in value, nor are salaries.

- 28** In tangentially related work, Hanushek, Rivkin and Taylor (1996) explore the influence of aggregation bias and omitted variables on estimates of the relationship between teacher characteristics and student outcomes, using data from the High School and Beyond survey. They find that at higher levels of aggregation, studies tend to overstate the strength of the relationship between resources and student outcomes, but raise the most significant concerns about studies using data aggregated to the state level with crude aggregate state level measures of student and population characteristics, far beyond the aggregation of most recent studies.
- E. A. Hanushek, S. Rivkin and L. L. Taylor, "Aggregation Bias and the Estimated Effects of School Resources," *Review of Economics and Statistics* 78, no. 4 (1996): 611-627. Along these lines, there does exist a separate body of literature that endeavors to prove that education spending is not associated with student outcomes by making national aggregate comparisons of spending and outcomes. That is, by showing that on average, countries that spend more per pupil don't perform better on international assessments. See, for example
- H. J. Walberg, "Spending More While Learning Less," *Fordham Report* 2, no. 6 (1998). These studies suffer sufficiently from aggregation issues to be of little importance to the discussion herein. While aggregation might lead to overstating the money-outcome relationship in some studies, these studies also suffer from numerous substantial measurement problems regarding both input and outcome measures. For example, education spending data are simply not directly comparable across nations, partly because they include vastly different programs and services (athletics, arts, special education) as well as other specific expenses, such as health insurance costs for U.S. school employees, that may be covered via other government programs in other nations.
- 29** Hanushek (1986) explains: "Thus the basic determinants of instructional expenditures in a district are teacher experience, teacher education and class size, and most studies, regardless of what other descriptors of schools might be included, will analyze the effect of these factors on outcomes" (p. 1160).
- 30** E. A. Hanushek, "Teacher Characteristics and Gains in Student Achievement: Estimation Using MicroData," *Econometrica* 61, no. 2 (1971): 280-288; C. T. Clotfelter, H. F. Ladd and J. L. Vigdor, "Teacher Credentials and Student Achievement:

Longitudinal Analysis with Student Fixed Effects," *Economics of Education Review* 26 (2007): 673-682; D. Goldhaber and D. Brewer, "Why Don't Schools and Teachers Seem to Matter? Assessing the Impact of Unobservables on Educational Productivity," *Journal of Human Resources* 332, no. 3 (1997): 505-523; R. G. Ehrenberg and D. J. Brewer, "Do School and Teacher Characteristics Matter? Evidence from High School and Beyond," *Economics of Education Review* 13, no. 1 (1994): 1-17; R. G. Ehrenberg and D. J. Brewer, "Did Teachers' Verbal Ability and Race Matter in the 1960s?," *Economics of Education Review* 14, no. 1 (1995): 1-21; C. Jepsen, "Teacher Characteristics and Student Achievement: Evidence from Teacher Surveys," *Journal of Urban Economics* 57, no. 2 (2005): 302-319; B. A. Jacob and L. Lefgren, "The Impact of Teacher Training on Student Achievement: Quasi-Experimental Evidence from School Reform," *Journal of Human Resources* 39, no. 1 (2004): 50-79; S. G. Rivkin, E. A. Hanushek and J. F. Kain, "Teachers, Schools, and Academic Achievement," *Econometrica* 73, no. 2 (2005): 471; and A. J. Wayne and P. Youngs, "Teacher Characteristics and Student Achievement Gains," *Review of Educational Research* 73, no. 1 (2003): 89-122. For a recent review of studies on the returns to teacher experience, see J. K. Rice, *The Impact of Teacher Experience: Examining the Evidence and Policy Implications* (National Center for Analysis of Longitudinal Data in Educational Research, 2010).

- 31** Some go so far as to argue that half or more of teacher pay is allocated to "non-productive" teacher attributes, and so it follows that that entire amount of funding could be reallocated toward making schools more productive. See, for example, a recent presentation to the New York State Board of Regents from Sept. 13, 2011 (page 32), slides by Stephen Frank of Education Resource Strategies: www.p12.nysed.gov/mgtserv/docs/SchoolFinanceForHighAchievement.pdf.
- 32** H. Lankford, S. Loeb and J. Wyckoff, "Teacher Sorting and the Plight of Urban Schools," *Educational Evaluation and Policy Analysis* 24 (2002): 37-62.
- 33** S. A. Allegretto, S. P. Corcoran and L. R. Mishel, *The Teaching Penalty: Teacher Pay Losing Ground* (Washington, DC: Economic Policy Institute, 2008).
- 34** R. J. Murnane and R. Olsen, "The Effects of Salaries and Opportunity Costs on Length of Stay in Teaching: Evidence from Michigan," *Review of Economics and Statistics* 71, no. 2 (1989): 347-352.
- 35** D. N. Figlio, "Can Public Schools Buy Better-Qualified

- Teachers?," *Industrial and Labor Relations Review* 55 (2002): 686-699; D. N. Figlio "Teacher Salaries and Teacher Quality," *Economics Letters* 55 (1997): 267-271; and R. Ferguson, "Paying for Public Education: New Evidence on How and Why Money Matters," *Harvard Journal on Legislation* 28, no. 2 (1991): 465-498.
- 36** S. Loeb and M. Page, "Examining the Link Between Teacher Wages and Student Outcomes: The Importance of Alternative Labor Market Opportunities and Non-Pecuniary Variation," *Review of Economics and Statistics* 82, no. 3 (2000): 393-408.
- 37** D. N. Figlio and K. Rueben, "Tax Limits and the Qualifications of New Teachers," *Journal of Public Economics* (April 2001): 49-71. See also T. A. Downes and D. N. Figlio, "Do Tax and Expenditure Limits Provide a Free Lunch? Evidence on the Link Between Limits and Public Sector Service Quality," *National Tax Journal* 52, no. 1 (1999): 113-128.
- 38** J. Ondrich, E. Pas and J. Yinger, "The Determinants of Teacher Attrition in Upstate New York," *Public Finance Review* 36, no. 1(2008): 112-144.
- 39** E. A. Hanushek, J. F. Kain and S. G. Rivkin, "Why Public Schools Lose Teachers," *Journal of Human Resources* 39, no. 2 (2004): 350.
- 40** C. Clotfelter, H. F. Ladd and J. Vigdor, "Teacher Mobility, School Segregation and Pay-Based Policies to Level the Playing Field," *Education Finance and Policy* 6, no. 3 (2011): 399-438; and C. T. Clotfelter, E. Glennie, H. F. Ladd and J. L. Vigdor, "Would Higher Salaries Keep Teachers in High-Poverty Schools? Evidence from a Policy Intervention in North Carolina," *Journal of Public Economics* 92 (2008): 1352-1370.
- 41** For major studies specifically on the topic of "merit pay," each of which generally finds no positive effects of merit pay on student outcomes, see S. Glazerman and A. Seifullah, *An Evaluation of the Teacher Advancement Program in Chicago: Year Two Impact Report* (Mathematica Policy Research Institute, 2010); M. G. Springer, D. Ballou, L. Hamilton, V. Le, J. R. Lockwood, D. McCaffrey, M. Pepper and B. Stecher, *Teacher Pay for Performance: Experimental Evidence from the Project on Incentives in Teaching* (Nashville, TN: National Center on Performance Incentives at Vanderbilt University, 2010); and J. A. Marsh, M. G. Springer, D. F. McCaffrey, K. Yuan, S. Epstein, J. Koppich, N. Kalra, C. DiMartino and A. Peng, *A Big Apple for Educators: New York City's Experiment with Schoolwide Performance Bonuses, Final Evaluation Report* (RAND Corporation and Vanderbilt University, 2011).
- 42** K. Yuan, V. N. Le, D. F. McCaffrey, J. A. Marsh, L. S. Hamilton, B. M. Stecher and M. G. Springer, "Incentive Pay Programs Do Not Affect Teacher Motivation or Reported Practices: Results from Three Randomized Studies," *Educational Evaluation and Policy Analysis* 35, no. 1 (2013); M. G. Springer, D. Ballou, L. Hamilton, V. N. Le, J. R. Lockwood, D. F. McCaffrey and B. M. Stecher, "Teacher Pay for Performance: Experimental Evidence from the Project on Incentives in Teaching (POINT)," *Society for Research on Educational Effectiveness* (2011); and M. G. Springer, J. F. Pane, V. N. Le, D. F. McCaffrey, S. F. Burns, L. S. Hamilton and B. Stecher, "Team Pay for Performance Experimental Evidence from the Round Rock Pilot Project on Team Incentives," *Educational Evaluation and Policy Analysis* 34, no. 4 (2012): 367-390.
- 43** T. S. Dee and J. Wyckoff, "Incentives, Selection, and Teacher Performance: Evidence from IMPACT," *Journal of Policy Analysis and Management* 34, no. 2 (2015): 267-297.
- 44** R. Balch and M. G. Springer, "Performance Pay, Test Scores, and Student Learning Objectives," *Economics of Education Review* 44 (2015): 114-125.
- 45** A. J. Sojourner, E. Mykerezi and K. L. West, "Teacher Pay Reform and Productivity Panel Data Evidence from Adoptions of Q-Comp in Minnesota," *Journal of Human Resources* 49, no. 4 (2014): 945-981.
- 46** R. G. Fryer Jr., S. D. Levitt, J. List and S. Sadoff, *Enhancing the Efficacy of Teacher Incentives through Loss Aversion: A Field Experiment* (no. w18237) (National Bureau of Economic Research, 2012).
- 47** M. D. Hendricks, *Public Schools Are Hemorrhaging Talented Teachers: Can Higher Salaries Function as a Tourniquet?*, March 24, 2015, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2564703.
- 48** M. D. Hendricks, "Towards an Optimal Teacher Salary Schedule: Designing Base Salary to Attract and Retain Effective Teachers," *Economics of Education Review* (2015), doi: 10.1016/j.econedurev.2015.05.008.
- 49** For a review of much the same literature, see www.shankerinstitute.org/blog/recent-evidence-teacher-experience-and-productivity.
- 50** M. Wiswall, "The Dynamics of Teacher Quality," *Journal of Public Economics* 100 (2013): 61-78.
- 51** J. P. Papay and M. A. Kraft, "Productivity Returns

- to Experience in the Teacher Labor Market: Methodological Challenges and New Evidence on Long-Term Career Improvement," *Journal of Public Economics* (2015).
- 52** H. F. Ladd and L. C. Sorensen, Returns to Teacher Experience: Student Achievement and Motivation in Middle School, Working Paper 112 (National Center for Analysis of Longitudinal Data in Education Research, 2014).
- 53** J. Rothstein, "Teacher Quality Policy When Supply Matters," Document de treball de IEB 35 (2012): 1-65; and J. Rothstein, Teacher Quality Policy When Supply Matters (no. w18419) (National Bureau of Economic Research, 2012).
- 54** www.americanprogress.org/issues/2011/04/pdf/class_size.pdf.
- 55** See, for example, D. J. Brewer, C. K. Kropp, B. P. Gill and R. Reichardt, "Estimating the Cost of National Class Size Reductions Under Different Policy Alternatives," *Educational Evaluation and Policy Analysis* 21, no. 2 (1999): 171-192. While this article provides insights into the cumulative costs of adding large numbers of teachers, it makes no comparisons to other strategies that might be employed for the same dollar. The article acknowledges the research on positive effects of class size and then estimates large-scale implementation costs, seemingly implying either that achieving these positive effects is simply too expensive or that there might be more cost-effective uses of the same dollar.
- 56** See <http://www2.ed.gov/rschstat/research/pubs/rigorousvid/rigorousvid.pdf>; J. D. Finn and C. M. Achilles, "Tennessee's Class Size Study: Findings, Implications, Misperceptions," *Educational Evaluation and Policy Analysis* 21, no. 2 (Summer 2009): 97-109; J. Finn et al., "The Enduring Effects of Small Classes," *Teachers College Record* 103, no. 2 (April 2001): 145-183, www.tcrecord.org/pdf/10725.pdf; A. Krueger, "Would Smaller Class Sizes Help Close the Black-White Achievement Gap," Working Paper 451 (Princeton, NJ: Industrial Relations Section, Department of Economics, Princeton University, 2001), www.irs.princeton.edu/pubs/working_papers.html; H. M. Levin, "The Public Returns to Public Educational Investments in African American Males" (Dijon Conference, University of Bourgogne, France, May 2006), <http://www.u-bourgogne.fr/colloque-iredu/posterscom/communications/LEVIN.pdf>; and S. Konstantopoulos and V. Chun, "What Are the Long-Term Effects of Small Classes on the Achievement Gap? Evidence from the Lasting Benefits Study," *American Journal of Education* 116, no. 1 (November 2009): 125-154.
- 57** A. Krueger, "Experimental Estimates of Education Production Functions," *Quarterly Journal of Economics* 114, no. 2 (1999): 497-532.
- 58** S. Konstantopoulos and V. Chun, "What Are the Long-Term Effects of Small Classes on the Achievement Gap? Evidence from the Lasting Benefits Study," *American Journal of Education* 116, no. 1 (November 2009): 125-154.
- 59** S. Dynarski, J. Hyman and D. W. Schanzenbach, "Experimental Evidence on the Effect of Childhood Investments on Postsecondary Attainment and Degree Completion," *Journal of Policy Analysis and Management* 32, no. 4 (2013): 692-717.
- 60** Another relevant study showing positive effects of pupil-to-teacher ratio reduction (different from class size) is the Wisconsin SAGE study. See A. Molnar, P. Smith, J. Zahorik, A. Palmer, A. Halbach and K. Ehrle, "Evaluating the SAGE Program: A Pilot Program in Targeted Pupil-Teacher Reduction in Wisconsin," *Educational Evaluation and Policy Analysis* 21, no. 2 (1999): 165-177. Unlike STAR, which was a true randomized experiment in Tennessee, SAGE in Wisconsin was designed as "a 5-year K-3 pilot project that began in the 1996-97 school year. The program required that participating schools implement 4 interventions including reducing the pupil-teacher ratio within classrooms to 15 students per teacher" (p. 165). Molnar and colleagues found: "Results of the 1996-97 and 1997-98 first grade data reveal findings consistent with the Tennessee STAR class size experiment" (p. 165). For an example of a study based on natural variation, finding no positive effects of smaller class size, see C. M. Hoxby, "The Effects of Class Size on Student Achievement: New Evidence from Population Variation," *Quarterly Journal of Economics* 115, no. 4 (2000): 1239-1285. Hoxby uses grade-level, not student-level, data on 649 elementary schools in Connecticut, concluding "class size does not have a statistically significant effect on student achievement" (p. 1239).
- 61** M. M. Chingos, "The False Promise of Class-Size Reduction" (Center for American Progress, 2011), https://cdn.americanprogress.org/wp-content/uploads/issues/2011/04/pdf/class_size.pdf.
- 62** M. M. Chingos, "Class Size and Student Outcomes: Research and Policy Implications," *Journal of Policy Analysis and Management* 32, no. 2 (2013): 411-438.
- 63** Referring to estimates provided by A. B. Krueger, "Experimental Estimates of Education Production Functions," *Quarterly Journal of Economics* 115

(1999): 497-532. See also H. Cho, P. Glewwe and M. Whitley, "Do Reductions in Class Size Raise Students' Test Scores? Evidence from Population Variation in Minnesota's Elementary Schools," *Economics of Education Review* 31 (2012): 77-95.

- 64** Head Start costs \$8,000 per child. Given the 6 percentage-point effect noted above, the amount spent by Head Start to induce a single child into college is therefore \$133,333 ($\$8,000/0.06$). For Abecedarian, the figure is \$410,000 ($\$90,000/0.22$). The cost of reduced class size is \$12,000 per student, larger than that of Head Start but considerably smaller than that of Abecedarian. The amount spent in STAR to induce a single child into college is \$400,000 ($\$12,000/0.03$). If the program could be focused on students in the poorest third of schools (the subpopulation that most closely matches that of the preschool interventions), then the cost drops to \$171,000 per student induced into college. Upward Bound costs \$5,620 per student. If the program could be targeted to students with low educational aspirations, the implied cost of inducing a single student into college is \$93,667 ($\$5,620/0.06$). Dynarski (2003) examines the effect of the elimination of the Social Security Student Benefit Program, which paid college scholarships to the dependents of deceased, disabled and retired Social Security beneficiaries. Eligible students were disproportionately black and low-income. The estimates from that paper indicate that about two-thirds of the treated students who attended college were inframarginal, while the other third was induced into the college by the \$7,000 scholarship. These estimates imply that three students are paid a scholarship in order to induce one into college. The cost per student induced into college is therefore \$21,000. Finally, the cost per treated subject in the FAFSA experiment (Bettinger et al., 2012) was \$88, for an implied cost per student induced into college of \$1,100 ($\$88/0.08$). S. Dynarski, J. M. Hyman and D. W. Schanzenbach, *Experimental Evidence on the Effect of Childhood Investments on Postsecondary Attainment and Degree Completion* (no. w17533) (National Bureau of Economic Research, 2011).
- 65** Including recent work linking participation in smaller class sizes with postsecondary degree attainment: S. Dynarski, J. M. Hyman and D. W. Schanzenbach, "Experimental Evidence on the Effect of Childhood Investments on Postsecondary Attainment and Degree Completion," NBER Working Paper 17533 (Cambridge, MA: National Bureau of Economic Research, 2011), www.nber.org/papers/w17533.
- 66** For other relatively recent studies on class size reduction, see R. Chetty, J. N. Friedman, N. Hilger, E. Saez, D. W. Schanzenbach and D. Yagan, "How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project STAR," NBER Working Paper 16381 (Cambridge, MA: National Bureau of Economic Research, 2010), www.nber.org/papers/w16381; P. Blatchford, P. Bassett and P. Brown, "Teachers' and Pupils' Behavior in Large and Small Classes: A Systematic Observation Study of Pupils Aged 10 and 11 Years," *Journal of Educational Psychology* 97, no. 3 (August 2005): 454-467, doi: 10.1037/0022-0663.97.3.454; P. Babcock and J. Betts, "Reduced Class Size Distinctions: Effort, Ability and the Education Production Function," NBER Working Paper 14777 (Cambridge, MA: National Bureau of Economic Research, 2009), www.nber.org/papers/w14777; and S. T. Lubienski, C. Lubienski and C. Crawford-Crane, "Achievement Differences and School Type: The Role of School Climate, Teacher Certification, and Instruction," *American Journal of Education* 115 (2008): 97-138.
- 67** C. Jepsen and S. Rivkin, "What Is the Tradeoff between Smaller Classes and Teacher Quality?," NBER Working Paper 9205 (Cambridge, MA: National Bureau of Economic Research, 2002), www.nber.org/papers/w9205. "The results show that, all else being equal, smaller classes raise third-grade mathematics and reading achievement, particularly for lower-income students. However, the expansion of the teaching force required to staff the additional classrooms appears to have led to a deterioration in average teacher quality in schools serving a predominantly black student body. This deterioration partially or, in some cases, fully offset the benefits of smaller classes, demonstrating the importance of considering all implications of any policy change" (p. 1). For further discussion of the complexities of evaluating class size reduction in a dynamic policy context, see D. Sims, "A Strategic Response to Class Size Reduction: Combination Classes and Student Achievement in California," *Journal of Policy Analysis and Management* 27, no. 3 (2008): 457-478; D. Sims, "Crowding Peter to Educate Paul: Lessons from a Class Size Reduction Externality," *Economics of Education Review* 28 (2009): 465-473; and M. M. Chingos, "The Impact of a Universal Class-Size Reduction Policy: Evidence from Florida's Statewide Mandate," *Program on Education Policy and Governance Working Paper 10-03* (2010).
- 68** R. G. Ehrenberg, D. Brewer, A. Gamoran and J. D. Willms, "Class Size and Student Achievement," *Psychological Science in the Public Interest* 2, no. 1 (2001): 1-30.
- 69** See B. D. Baker, D. Farrie, D. Sciarra and R. Coley, "Is School Funding Fair," 2010, www.

schoolfundingfairness.org.

- 70** Two reports from Cato are illustrative: P. Ciotti, *Money and School Performance: Lessons from the Kansas City Desegregations Experience*, *Cato Policy Analysis* 298 (1998); and D. Coate and J. VanderHoff, "Public School Spending and Student Achievement: The Case of New Jersey," *Cato Journal* 19, no. 1 (1999): 85-99. Edspresso, *New Jersey Learns Kansas City's Lessons the Hard Way* (2006), retrieved Oct. 23, 2009, from www.edspresso.com/index.php/2006/10/new-jersey-learns-kansas-citys-lessons-the-hard-way-2.
- 71** E. A. Hanushek and A. Lindseth, *Schoolhouses, Courthouses and Statehouses* (Princeton, NJ: Princeton University Press, 2009). See also http://edpro.stanford.edu/Hanushek/admin/pages/files/uploads/06_EduO_Hanushek_g.pdf.
- 72** Kevin Welner and I explain that Hanushek and Lindseth failed to even measure whether substantive changes had occurred to the level or distribution of school funding as well as when and for how long. We point out that in New Jersey, for example, infusion of funding occurred from 1998 to 2003 (or 2005), thus Hanushek and Lindseth's window includes six years on the front end where little change occurred. Kentucky reforms had largely faded by the mid- to late 1990s, yet Hanushek and Lindseth measure postreform effects in 2007. Further, in New Jersey, funding was infused into approximately 30 specific districts, but Hanushek and Lindseth explore overall changes to outcomes among low-income children and minorities using NAEP data, where some of these children attend the districts receiving additional support but many did not. In short, the slipshod comparisons made by Hanushek and Lindseth provide no reasonable basis for asserting either the success or failure of state school finance reforms. We also discuss other studies that involve similar flaws of reasoning. For example, Greene and Trivitt present a study in which they claim to show that court-ordered school finance reforms led to no substantive improvements in student outcomes. However, the authors test only whether the presence of a court order is associated with changes in outcomes, and never once measure whether substantive school finance reforms followed the court order. See J. P. Greene and J. R. Trivitt, "Can Judges Improve Academic Achievement?," *Peabody Journal of Education* 83, no. 2 (2008): 224-237. In an equally problematic analysis, Florence Neymotin set out to show that massive court-ordered infusions of funding in Kansas following *Montoy v. Kansas* led to no substantive improvements in student outcomes. However, Welner and I explain that Neymotin evaluated changes in school funding from 1997 to 2006, but the first additional funding infused following the January 2005 Supreme Court decision occurred in the 2005-06 school year, the end point of Neymotin's outcome data. F. Neymotin, "The Relationship between School Funding and Student Achievement in Kansas Public Schools," *Journal of Education Finance* 36, no. 1 (2010): 88-108.
- 73** In an earlier, edited volume, Hanushek goes so far as to title the book "How School Finance Lawsuits Exploit Judges' Good Intentions and Harm Our Children" (emphasis added). The premise that additional funding for schools, often leveraged toward class size reduction, additional course offerings or increased teacher salaries, causes harm to children is, on its face, absurd. And the book, which implies as much in its title, never once validates that such reforms ever do cause harm. Rather, the title is little more than a manipulative attempt to convince the noncritical spectator who never gets past the book's cover to fear that school finance reforms might somehow harm children. That is, adding an element of fear to the cloud of doubt. See, for example, E. A. Hanushek, *Courting Failure: How School Finance Lawsuits Exploit Judges' Good Intentions and Harm Our Children* (Hoover Institution Press, 2006). A review of the book is available at www.tcrecord.org/Content.asp?ContentId=13382. This book also includes two examples of a type of analysis that occurred with some frequency in the mid-2000s that also had the intent of showing that school funding doesn't matter. These studies would cherry pick anecdotal information from either or both (a) poorly funded schools that have high outcomes; and (b) well-funded schools that have low outcomes. The implication would be that if such schools exist, money must not matter. See W. M. Evers and P. Clopton, "High-Spending, Low-Performing School Districts," in *Courting Failure: How School Finance Lawsuits Exploit Judges' Good Intentions and Harm Our Children*, ed. E. A. Hanushek (Palo Alto, CA: Hoover Press, 2006), 103-194; and H. Walberg, "High-Poverty, High-Performance Schools, Districts and States," in *Courting Failure: How School Finance Lawsuits Exploit Judges' Good Intentions and Harm Our Children*, ed. E. A. Hanushek (Palo Alto, CA: Hoover Press, 2006), 79-102.
- 74** For additional discussion of the strengths and weaknesses of this particular study, see Baker and Welner (2011).
- 75** D. Card and A. A. Payne, "School Finance Reform, the Distribution of School Spending, and the

Distribution of Student Test Scores," *Journal of Public Economics* 83, no. 1 (2002): 49-82. See Baker and Welner (2011) for a more thorough discussion of the Card and Payne analysis and its strengths and weaknesses.

- 76** The authors explain: "Our sample consists of PSID sample members born between 1955 and 1985 who have been followed from 1968 into adulthood through 2011. This corresponds to cohorts that both straddle the first set of court-mandated SFRs (the first of which was in 1972) and are old enough to have completed formal schooling by 2011. Two-thirds of those in these cohorts in the PSID grew up in a school district that was subject to a court-mandated school finance reform between 1972 and 2000." C. K. Jackson, R. C. Johnson and C. Persico, *The Effects of School Spending on Educational and Economic Outcomes: Evidence from School Finance Reforms* (no. w20847) (National Bureau of Economic Research, 2015).
- 77** B. Baker and K. Welner, "School Finance and Courts: Does Reform Matter, and How Can We Tell," *Teachers College Record* 113, no. 11 (2011): 2374-2414.
- 78** <http://educationnext.org/boosting-education-attainment-adult-earnings-school-spending>.
- 79** In fact, a table often cited by Hanushek to show that investment in low-income schools has increased over time shows that by 2006-07, lower-income schools, nationally, were spending, on average, slightly more than \$100 per pupil more than higher income schools. See Table A-36-1: S. Aud, W. Hussar, M. Planty, T. Snyder, K. Bianco, M. Fox, L. Frohlich, J. Kemp and L. Drake, *The Condition of Education 2010* (NCES 2010-028) (Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, 2010). This national average margin of about 1.2 percent is hardly sufficient for eliminating all achievement gaps, as explained by Duncombe and Yinger: W. Duncombe and J. Yinger, "Why Is It So Hard to Help Central City Schools?," *Journal of Policy Analysis and Management* 16, no. 1 (1997): 85-113; and W. Duncombe and J. Yinger, "How Much More Does a Disadvantaged Student Cost?," *Economics of Education Review* 24, no. 5 (2005): 513-532.
- 80** D. N. Figlio, "Funding and Accountability: Some Conceptual and Technical Issues in State Aid Reform," in *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity*, ed. J. Yinger (MIT Press, 2004), 87-111. This synopsis of Figlio's main points actually comes from an earlier chapter in the same volume, by volume editor John Yinger: J. Yinger, "State Aid and the Pursuit of Educational Equity: An Overview," in *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity*, ed. J. Yinger (MIT Press, 2004), 39.
- 81** J. Roy, "Impact of School Finance Reform on Resource Equalization and Academic Performance: Evidence from Michigan," *Education Finance and Policy* 6, no. 2 (2011): 137-167. Roy (2011) published an analysis of the effects of Michigan's school finance reforms of the 1990s, which led to a significant leveling up for previously low-spending districts. Roy, whose analyses measure both whether the policy resulted in changes in funding and who was affected, found that "Proposal A was quite successful in reducing interdistrict spending disparities. There was also a significant positive effect on student performance in the lowest-spending districts as measured in state tests" (p. 137).
- 82** L. Papke, "The Effects of Spending on Test Pass Rates: Evidence from Michigan," *Journal of Public Economics* 89, no. 5-6 (2005): 821-839; and J. Hyman, *Does Money Matter in the Long Run? Effects of School Spending on Educational Attainment* (2013), www-personal.umich.edu/~jmhyman/Hyman_JMP.pdf.
- 83** J. Roy, "Impact of School Finance Reform on Resource Equalization and Academic Performance: Evidence from Michigan," *Education Research Section Working Paper No. 8* (Princeton University, 2003), retrieved Oct. 23, 2009, from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=630121 (forthcoming in *Education Finance and Policy*).
- 84** L. Papke, "The Effects of Spending on Test Pass Rates: Evidence from Michigan," *Journal of Public Economics* 89, no. 5-6 (2005): 821-839. In a separate study, Leuven and colleagues attempted to isolate specific effects of increases to at-risk funding on at-risk pupil outcomes but did not find any positive effects. E. Leuven, M. Lindahl, H. Oosterbeek and D. Webbink, "The Effect of Extra Funding for Disadvantaged Pupils on Achievement," *Review of Economics and Statistics* 89, no. 4 (2007): 721-736.
- 85** J. Hyman, *Does Money Matter in the Long Run? Effects of School Spending on Educational Attainment* (2013), www-personal.umich.edu/~jmhyman/Hyman_JMP.pdf.
- 86** J. Deke, "A Study of the Impact of Public School Spending on Postsecondary Educational Attainment Using Statewide School District Refinancing in Kansas," *Economics of Education Review* 22, no. 3 (2003): 275-284.

- 87** T. A. Downes, J. Zabel and D. Ansel, *Incomplete Grade: Massachusetts Education Reform at 15* (Boston, MA: MassINC, 2009).
- 88** J. Guryan, "Does Money Matter? Estimates from Education Finance Reform in Massachusetts," Working Paper No. 8269 (Cambridge, MA: National Bureau of Economic Research, 2001). While this paper remains an unpublished working paper, the advantage of Guryan's analysis is that he models the expected changes in funding at the local level as a function of changes to the school finance formula itself, through what is called an instrumental variables or two-stage least squares approach. Then, Guryan evaluates the extent to which these policy-induced variations in local funding are associated with changes in student outcomes. Across several model specifications, Guryan finds increased outcomes for students at grade 4 but not at grade 8. A counter study by the Beacon Hill Institute suggests that reduced class size and/or increased instructional spending either has no effect on or actually worsens student outcomes. S. Jaggia and V. Vachharajani, *Money for Nothing: The Failures of Education Reform in Massachusetts* (2004), www.beaconhill.org/BHISTudies/EdStudy5_2004/BHIEdStudy52004.pdf.
- 89** P. Nguyen-Hoang and J. Yinger, "Education Finance Reform, Local Behavior, and Student Performance in Massachusetts," *Journal of Education Finance* 39, no. 4 (2014): 297-322.
- 90** T. A. Downes, "School Finance Reform and School Quality: Lessons from Vermont," in *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity*, ed. J. Yinger (Cambridge, MA: MIT Press, 2004).
- 91** Two studies of school finance reforms in New Jersey also merit some attention, in part because they directly refute findings of Hanushek and Lindseth and of the earlier Cato study, and do so with more rigorous and detailed methods. The first, by Alex Resch of the University of Michigan (doctoral dissertation in economics), explored in detail the resource allocation changes during the scaling-up period of school finance reform in New Jersey. Resch found evidence suggesting that New Jersey Abbott districts "directed the added resources largely to instructional personnel" (p. 1), such as additional teachers and support staff. She also concluded that this increase in funding and spending improved the achievement of students in the affected school districts. Looking at the statewide 11th-grade assessment ("the only test that spans the policy change"), she found "that the policy improves test scores for minority students in the affected districts by one-fifth to one-quarter of a standard deviation" (p. 1). Goertz and Weiss (2009) also evaluated the effects of New Jersey school finance reforms but did not attempt a specific empirical test of the relationship between funding level and distributional changes and outcome changes. Thus, their findings are primarily descriptive. Goertz and Weiss explain that on state assessments, achievement gaps closed substantially between 1999 and 2007, the period over which Abbott funding was most significantly scaled up. A. M. Resch, *Three Essays on Resources in Education* (dissertation) (Ann Arbor: University of Michigan, Department of Economics, 2008), retrieved Oct. 28, 2009, from http://deepblue.lib.umich.edu/bitstream/2027.42/61592/1/aresch_1.pdf; and M. Goertz and M. Weiss, *Assessing Success in School Finance Litigation: The Case of New Jersey* (New York City: Campaign for Educational Equity, Teachers College, Columbia University, 2009). The authors explain: "State Assessments: In 1999 the gap between the Abbott districts and all other districts in the state was over 30 points. By 2007 the gap was down to 19 points, a reduction of 11 points or 0.39 standard deviation units. The gap between the Abbott districts and the high-wealth districts fell from 35 to 22 points. Meanwhile performance in the low-, middle-, and high-wealth districts essentially remained parallel during this eight-year period" (Figure 3, p. 23).
- 92** F. Neymotin, "The Relationship between School Funding and Student Achievement in Kansas Public Schools," *Journal of Education Finance* 36, no. 1 (2010): 88-108; and J. P. Greene and J. R. Trivitt, "Can Judges Improve Academic Achievement?," *Peabody Journal of Education* 83, no. 2 (2008): 224-237. See our critique of these studies B. Baker and K. Welner, "School Finance and Courts: Does Reform Matter, and How Can We Tell," *Teachers College Record* 113, no. 11 (2011): 2374-2414..
- 93** W. Duncombe and J. Yinger, "Financing Higher Student Performance Standards: The Case of New York State," *Economics of Education Review* 19, no. 4 (2000): 363-386; A. Reschovsky and J. Imazeki, "Achieving Educational Adequacy through School Finance Reform," *Journal of Education Finance* (2001): 373-396;
J. Imazeki and A. Reschovsky, "Is No Child Left Behind an Un (or Under) Funded Federal Mandate? Evidence from Texas," *National Tax Journal* (2004): 571-588; J. Imazeki and A. Reschovsky, "Does No Child Left Behind Place a Fiscal Burden on States? Evidence from Texas," *Education Finance and Policy* 1, no. 2 (2006): 217-246; and J. Imazeki and A. Reschovsky, "Assessing the Use of Econometric Analysis in Estimating the Costs of Meeting State

- Education Accountability Standards: Lessons from Texas," *Peabody Journal of Education* 80, no. 3 (2005): 96-125.
- 94** T. A. Downes and T. F. Pogue, "Adjusting School Aid Formulas for the Higher Cost of Educating Disadvantaged Students," *National Tax Journal* (1994): 89-110; W. Duncombe and J. Yinger, "School Finance Reform: Aid Formulas and Equity Objectives," *National Tax Journal* (1998): 239-262; W. Duncombe and J. Yinger, "Why Is It So Hard to Help Central City Schools?," *Journal of Policy Analysis and Management* 16, no. 1 (1997): 85-113; and W. Duncombe and J. Yinger, "How Much More Does a Disadvantaged Student Cost?," *Economics of Education Review* 24, no. 5 (2005): 513-532.
- 95** For a discussion, see B. D. Baker, "The Emerging Shape of Educational Adequacy: From Theoretical Assumptions to Empirical Evidence," *Journal of Education Finance* (2005): 259-287. See also M. Andrews, W. Duncombe and J. Yinger, "Revisiting Economies of Size in American Education: Are We Any Closer to a Consensus?," *Economics of Education Review* 21, no. 3 (2002): 245-262; W. Duncombe, J. Miner and J. Ruggiero, "Potential Cost Savings from School District Consolidation: A Case Study of New York," *Economics of Education Review* 14, no. 3 (1995): 265-284; J. Imazeki and A. Reschovsky, "Financing Adequate Education in Rural Settings," *Journal of Education Finance* (2003): 137-156; and T. J. Gronberg, D. W. Jansen and L. L. Taylor, "The Impact of Facilities on the Cost of Education," *National Tax Journal* 64, no. 1 (2011): 193-218.
- 96** T. Downes, *What Is Adequate? Operationalizing the Concept of Adequacy for New York State* (2004), <http://www.albany.edu/edfin/Downes%20EFRC%20Symp%2004%20Single.pdf>.
- 97** See, for example, B. D. Baker, "Exploring the Sensitivity of Education Costs to Racial Composition of Schools and Race-Neutral Alternative Measures: A Cost Function Application to Missouri," *Peabody Journal of Education* 86, no. 1 (2011): 58-83.
- 98** Completed and released in 2006, eventually published as J. Imazeki, "Assessing the Costs of Adequacy in California Public Schools: A Cost Function Approach," *Education* 3, no. 1 (2008): 90-108.
- 99** See the acknowledgements at <http://files.eric.ed.gov/fulltext/ED508961.pdf>. Final published version: R. Costrell, E. Hanushek and S. Loeb, "What Do Cost Functions Tell Us about the Cost of an Adequate Education?," *Peabody Journal of Education* 83, no. 2 (2008): 198-223.
- 100** W. Duncombe and J. Yinger, "Are Education Cost Functions Ready for Prime Time? An Examination of Their Validity and Reliability," *Peabody Journal of Education* 86, no. 1 (2011): 28-57. See also W. Duncombe and J. M. Yinger, "A Comment on School District Level Production Functions Estimated Using Spending Data" (Maxwell School of Public Affairs, Syracuse University, 2007); and W. Duncombe and J. Yinger, "Making Do: State Constraints and Local Responses in California's Education Finance System," *International Tax and Public Finance* 18, no. 3 (2011): 337-368. For an alternative approach, see T. J. Gronberg, D. W. Jansen and L. L. Taylor, "The Adequacy of Educational Cost Functions: Lessons from Texas," *Peabody Journal of Education* 86, no. 1 (2011): 3-27.
- 101** W. Duncombe and J. Yinger, "Are Education Cost Functions Ready for Prime Time? An Examination of Their Validity and Reliability," *Peabody Journal of Education* 86, no. 1 (2011): 28-57. See also W. Duncombe and J. M. Yinger, "A Comment on School District Level Production Functions Estimated Using Spending Data" (Maxwell School of Public Affairs, Syracuse University, 2007). For an alternative approach, see T. J. Gronberg, D. W. Jansen and L. L. Taylor, "The Adequacy of Educational Cost Functions: Lessons from Texas," *Peabody Journal of Education* 86, no. 1 (2011): 3-27.
- 102** P. J. Wolf, A. Cheng, M. Batdorff, L. Maloney, J. F. May and S. T. Speakman, *The Productivity of Public Charter Schools* (Fayetteville, AR: Department of Education Reform, University of Arkansas, 2014), retrieved Aug. 5, 2014, from www.uaedreform.org/downloads/2014/07/the-productivity-of-public-charter-schools.pdf.
- 103** Some, however, find that charter school expansion may exert negative effects through student/peer sorting:
"Results show that charters induce modest but statistically significant drops in math and language test scores, particularly for elementary students. However, results for middle and high school students show improvements in discipline." S. A. Imberman, "The Effect of Charter Schools on Achievement and Behavior of Public School Students," *Journal of Public Economics* 95, no. 7 (2011): 850-863. Epple, Romano and Zimmer (2015) discuss the much larger literature on this topic: D. Epple, R. Romano and R. Zimmer, *Charter Schools: A Survey of Research on Their Characteristics and Effectiveness* (no. w21256) (National Bureau of Economic Research, 2015).

- 104** D. Epple, R. Romano and R. Zimmer, Charter Schools: A Survey of Research on Their Characteristics and Effectiveness (no. w21256) (National Bureau of Economic Research, 2015). More recent studies have affirmed the weak outcomes of Online Charter schools: Center for Research on Education Outcomes (2015) Online Charter School Study. <https://credo.stanford.edu/pdfs/Online%20Charter%20Study%20Final.pdf> Gill, B., Walsh, L., Wulsin, C. S., Matulewicz, H., Severn, V., Grau, E., & Kerwin, T. (2015). Inside Online Charter Schools (No. 9c4fae4409c44298a559a14ea948fb2c). Mathematica Policy Research.
- 105** P. J. Wolf, A. Cheng, M. Batdorff, L. Maloney, J. F. May and S. T. Speakman, The Productivity of Public Charter Schools (Fayetteville, AR: Department of Education Reform, University of Arkansas, 2014), retrieved Aug. 5, 2014, from www.uaedreform.org/downloads/2014/07/the-productivity-of-public-charter-schools.pdf; and G. V. Glass, Review of "The Productivity of Public Charter Schools" (Boulder, CO: National Education Policy Center, 2014), <http://nepc.colorado.edu/thinktank/review-productivity-public-charter>.
- 106** B. D. Baker, Review of "Charter Funding: Inequity Expands" (Boulder, CO: National Education Policy Center, 2014), <http://nepc.colorado.edu/thinktank/review-charter-funding-inequity>.
- 107** D. Epple, R. Romano and R. Zimmer, Charter Schools: A Survey of Research on Their Characteristics and Effectiveness (no. w21256) (National Bureau of Economic Research, 2015).
- 108** C. C. Tuttle, B. Gill, P. Gleason, V. Knechtel, I. Nichols-Barrer and A. Resch, KIPP Middle Schools: Impacts on Achievement and Other Outcomes, Final Report (Mathematica Policy Research, 2013). Angrist, J. D., Dynarski, S. M., Kane, T. J., Pathak, P. A., & Walters, C. R. (2010). Inputs and impacts in charter schools: KIPP Lynn. *American Economic Review*, 100(2), 239-243.
- 109** B. D. Baker, K. Libby and K. Wiley, Spending by the Major Charter Management Organizations: Comparing Charter School and Local Public District Financial Resources in New York, Ohio, and Texas (National Education Policy Center, 2012); and B. D. Baker, K. Libby and K. Wiley, "Charter School Expansion and Within-District Equity: Confluence or Conflict?," *Education Finance and Policy* (2015). Others report similar resource differentials (and more) for KIPP schools: T. J. Gronberg, D. W. Jansen and L. L. Taylor, "The Relative Efficiency of Charter Schools: A Cost Frontier Approach," *Economics of Education Review* 31, no. 2 (2012): 302-317.
- 110** W. Dobbie and R. G. Fryer Jr., Getting Beneath the Veil of Effective Schools: Evidence from New York City (no. w17632) (National Bureau of Economic Research, 2011). The authors note: "We find that traditionally collected input measures—class size, per pupil expenditure, the fraction of teachers with no certification, and the fraction of teachers with an advanced degree—are not correlated with school effectiveness."
- 111** B. D. Baker, K. Libby and K. Wiley, Spending by the Major Charter Management Organizations: Comparing Charter School and Local Public District Financial Resources in New York, Ohio, and Texas (National Education Policy Center, 2012); and B. D. Baker, K. Libby and K. Wiley, "Charter School Expansion and Within-District Equity: Confluence or Conflict?," *Education Finance and Policy* (2015). Others report similar resource differentials (and more) for KIPP schools: T. J. Gronberg, D. W. Jansen and L. L. Taylor, "The Relative Efficiency of Charter Schools: A Cost Frontier Approach," *Economics of Education Review* 31, no. 2 (2012): 302-317.
- 112** Others also explain that many charter schools may achieve positive outcome effects by increasing the length of school days, providing additional weekend instruction and extending school years into the summer months. The additional costs associated with all of this additional time are kept in check by employing inexperienced teachers and leveraging the lack of collective bargaining (in many charters) to require the longer hours and years, with less regard for "burnout" or turnover because turnover keeps staffing costs low. Again, scalability of these strategies is questionable. In all likelihood, systemwide expansion of school days and school years would require additional resources. Abdulkadiro lu, A., Angrist, J. D., Dynarski, S. M., Kane, T. J., & Pathak, P. A. (2011). Accountability and flexibility in public schools: Evidence from Boston's charters and pilots. *The Quarterly Journal of Economics*, 126(2), 699-748. Hoxby, C. M., Murarka, S., & Kang, J. (2009). How New York City's charter schools affect achievement. Cambridge, MA: New York City Charter Schools Evaluation Project, 1-85.
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- 114** T. J. Gronberg, D. W. Jansen and L. L. Taylor, "The

Relative Efficiency of Charter Schools: A Cost Frontier Approach," *Economics of Education Review* 31, no. 2 (2012): 302-317.

- 115** L. L. Taylor, B. L. Alford, K. G. Rollins, D. B. Brown, J. R. Stillitano and H. C. Waxman, "Evaluation of Texas Charter Schools 2009-2010" (Revised Draft) (Texas Education Research Center, Texas A&M University, College Station, 2011).
- 116** D. Epple, R. Romano and R. Zimmer, *Charter Schools: A Survey of Research on Their Characteristics and Effectiveness* (no. w21256) (National Bureau of Economic Research, 2015).
- 117** E. A. Hanushek, "Economics of Schooling: Production and Efficiency in Public Schools," *Journal of Economic Literature* 24, no. 3 (1986): 1141-1177. A few years later, Hanushek paraphrased this conclusion in another widely cited article as "Variations in school expenditures are not systematically related to variations in student performance." E. A. Hanushek, "The Impact of Differential Expenditures on School Performance," *Educational Researcher* 18, no. 4 (1989): 45-62.
- 118** Kevin Welner and I discuss at length Hanushek and Lindseth's strange heavy reliance on these two Cato reports from the late 1990s on Kansas City and New Jersey, as if these reports are the seminal works of the field. Yet, amazingly, Hanushek and Lindseth ignore outright most of the major peer-reviewed articles on school finance reform by credible researchers using credible methods, addressed herein and addressed in my article with Welner: B. Baker and K. Welner, "School Finance and Courts: Does Reform Matter, and How Can We Tell," *Teachers College Record* 113, no. 11 (2011): 2374-2414. For example, in a Hoover Institution commentary regarding school funding litigation in New York state, Hanushek (2002) noted: "One need only look at the results in Kansas City. A school desegregation ruling in the 1980s began a period of more than a decade when the schools had access to virtually unlimited state funds. The dreams of school personnel did not translate into any measurable gains in student performance, even as their schools moved to the very top of national spending." A PDF of this op-ed is available on Eric Hanushek's website, at http://edpro.stanford.edu/hanushek/admin/pages/files/uploads/hanushek_0302.pdf. Baker and Green explain the various mythologies embedded in this particular statement. See P. C. Green and B. D. Baker, "Urban Legends, Desegregation and School Finance: Did Kansas City Really Prove That Money Doesn't Matter?," *Michigan Journal of Race and Law* 12, no. 1 (2006): 57-105.
- 119** <http://www.edlawcenter.org/assets/files/pdfs/maisto/masito%20trial%20documents/State%27s%20Expert%20Report%20-%20Dr.%20Eric%20Hanushek.pdf>.
- 120** B. D. Baker, *Revisiting the Age-Old Question: Does Money Matter in Education?* (Albert Shanker Institute, 2012).
- 121** Specifically, Hanshek includes the following footnote: "Hanushek (2003). See also Hanushek (1981, (1986, (1989). The statistical analyses focus on the independent impact of resources on performance after allowing for differences among families, peers, and neighborhoods. A variety of sophisticated approaches have been applied to schooling situations across the countries, and the reviews summarize these studies. The aggregate results of the most sophisticated of these studies are shown below." <http://www.edlawcenter.org/assets/files/pdfs/maisto/masito%20trial%20documents/State%27s%20Expert%20Report%20-%20Dr.%20Eric%20Hanushek.pdf>.
- 122** C. K. Jackson, R. C. Johnson and C. Persico, *The Effects of School Spending on Educational and Economic Outcomes: Evidence from School Finance Reforms* (no. w20847) (National Bureau of Economic Research, 2015).
- 123** <http://hanushek.stanford.edu/opinions/does-money-matter-after-all>.
- 124** <http://hanushek.stanford.edu/sites/default/files/publications/Hanushek%202003%20EJ%20113%28485%29.pdf>.
- 125** <http://www.edlawcenter.org/assets/files/pdfs/maisto/masito%20trial%20documents/State%27s%20Expert%20Report%20-%20Dr.%20Eric%20Hanushek.pdf>.
- 126** www.edlawcenter.org/assets/files/pdfs/maisto/masito%20trial%20documents/State%27s%20Expert%20Report%20-%20Dr.%20Eric%20Hanushek.pdf.
- 127** <http://educationnext.org/money-matter>.
- 128** <http://www.shawneecourt.org/DocumentCenter/View/457>.
- 129** B. Baker and K. Welner, "School Finance and Courts: Does Reform Matter, and How Can We Tell," *Teachers College Record* 113, no. 11 (2011): 2374-2414.
- 130** <http://www.edlawcenter.org/assets/files/>

- [pdfs/maisto/masito%20trial%20documents/State%20Expert%20Report%20-%20Dr.%20Eric%20Hanushek.pdf](http://pdfs.maisto.masito%20trial%20documents/State%20Expert%20Report%20-%20Dr.%20Eric%20Hanushek.pdf).
- 131** http://junkcharts.typepad.com/junk_charts/2011/04/bill-gates-should-hire-a-statistical-advisor.html.
- 132** See, for example, http://www.epi.org/publication/fact-challenged_policy.
- 133** The authors explain: "To see the problems of Hanushek's logic, consider the following true statistics: between 1960 and 2000 the rate of cigarette smoking for females decreased by more than 30 percent while the rate of deaths by lung cancer increased by more than 50 percent over the same time period. [1] An analysis of these time trends might lead one to infer that smoking reduces lung cancer. However, most informed readers can point out numerous flaws in looking at this time trend evidence and concluding that 'if smoking causes lung cancer, then there should have been a large corresponding reduction in cancer rates so that there can be no link between smoking and lung cancer.' However, this is exactly the facile logic invoked by Hanushek regarding the effect of school spending on student achievement" (Jackson, K., Johnson, R.C., Persico, C. (2015) Money Does Matter After All. Education Next. <http://educationnext.org/money-matter>) .
- 134** B. Baker and K. Welner, "School Finance and Courts: Does Reform Matter, and How Can We Tell," Teachers College Record 113, no. 11 (2011): 2374-2414.
- 135** <http://www.robblaw.com/PDFs/1169.pdf>.
- 136** <http://www.edlawcenter.org/assets/files/pdfs/maisto/masito%20trial%20documents/State%20Expert%20Report%20-%20Dr.%20Eric%20Hanushek.pdf>.
- 137** As explained by the authors: "We also examine changes in student performance in 41 states within the United States between 1992 and 2011, allowing us to compare these states with each other. Our findings come from assessments of performance in math, science, and reading of representative samples in particular political jurisdictions of students who at the time of testing were in 4th or 8th grade or were roughly ages 9-10 or 14-15."
- 138** E. A. Hanushek, P. E. Peterson and L. Woessmann, "Is the US Catching Up: International and State Trends in Student Achievement," Education Next 12, no. 4 (2012): 24, http://www.hks.harvard.edu/pepg/PDF/Papers/PEPG12-03_CatchingUp.pdf.
- 139** <http://jaypgreene.com/2015/05/29/does-school-spending-matter-after-all>.
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- 141** R. Murnane, "Interpreting the Evidence on Does Money Matter?," Harvard Journal of Legislation 28 (1991): 457-464.
- 142** B. Baker and K. Welner, "School Finance and Courts: Does Reform Matter, and How Can We Tell," Teachers College Record 113, no. 11 (2011): 2374-2414.
- 143** <http://www.shawneecourt.org/DocumentCenter/View/457>.
- 144** H. Rose and J. R. Betts, "The Effect of High School Courses on Earnings," Review of Economics and Statistics 86, no. 2 (2004): 510; A. Gamoran and E. C. Hannigan, "Algebra for Everyone? Benefits of College-Preparatory Mathematics for Students with Diverse Abilities in Early Secondary School," Educational Evaluation and Policy Analysis 22, no. 3 (Fall 2000): 241-254; M. C. Long, P. Iatarola and D. Conger, "Explaining Gaps in Readiness for College-Level Math: The Role of High School Courses," Education Finance and Policy 4, no. 1 (Winter 2009): 1-33; and Leslie Killgore, "Merit and Competition in Selective College Admissions," Review of Higher Education 32, no. 4 (Summer 2009): 471.
- 145** B. D. Baker, "Cheerleading, Ceramics and the Non-Productive Use of Educational Resources in High Need Districts: Really?" (paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA, 2011), http://schoolfinance101.files.wordpress.com/2010/01/b-baker-mo_il-resourcealloc-aera2011.pdf.
- 146** C. Taylor, "Does Money Matter? An Empirical Study Introducing Resource Costs and Student Needs into Educational Production Function Analysis," in Developments in School Finance, 1997, ed. W. J. Fowler Jr. (Washington, DC: U.S. Department of Education, National Center for Education Statistics, 1998), <http://nces.ed.gov/pubs98/98212.pdf#page=83>.
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- 148** G. Borman and G. Hewes, "The Long-Term Effects and Cost-Effectiveness of Success for All,"

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- 149** R. Fryer, "Creating 'No Excuses' (Traditional) Public Schools: Preliminary Evidence from an Experiment in Houston," NBER Working Paper 17494 (Cambridge, MA: National Bureau of Economic Research, 2011), www.nber.org/papers/w17494.
- 150** E. A. Hanushek, "Empirical and Conceptual Issues in the Estimation of Educational Production Functions," *Journal of Human Resources* 14, no. 3 (1979): 351-388.
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- 152** B. D. Baker, "Exploring the Sensitivity of Education Costs to Racial Composition of Missouri School Districts," *Peabody Journal of Education* 86, no. 1 (2011): 58-83; W. Duncombe and J. Yinger, "How Much More Does a Disadvantaged Student Cost?," *Economics of Education Review* 24, no. 5 (2005): 513-532; W. Duncombe and J. M. Yinger, "Financing Higher Performance Standards: The Case of New York State," *Economics of Education Review* 19, no. 3 (2000): 363-386; W. Duncombe, A. Lukemeyer and J. Yinger, "The No Child Left Behind Act: Have Federal Funds Been Left Behind?," *Public Finance Review* 36, no. 4 (2008): 381-407; W. Duncombe and J. M. Yinger, "Performance Standards and Education Cost Indexes: You Can't Have One Without the Other," in *Equity and Adequacy in Education Finance: Issues and Perspectives*, ed. H. F. Ladd, R. Chalk and J. S. Hansen (Washington, DC: National Academy Press, 1999), 260-297; W. Duncombe and J. M. Yinger, "School Finance Reforms: Aid Formulas and Equity Objectives," *National Tax Journal* 51, no. 2 (1998): 239-263; W. Duncombe and J. M. Yinger, "Why Is It So Hard to Help Central City Schools?," *Journal of Policy Analysis and Management* 16, no. 1 (1997): 85-113; T. Gronberg, D. Jansen, L. Taylor and K. Booker, *School Outcomes and Schools Costs: The Cost Function Approach* (College Station, TX: Busch School of Government and Public Service, Texas A&M University, 2004), retrieved March 1, 2006, from http://bush.tamu.edu/research/faculty_projects/txschoolfinance/papers/SchoolOutcomesAndSchoolCosts.pdf; J. Imazeki and A. Reschovsky, "Is No Child Left Beyond an Un (or Under) Funded Federal Mandate? Evidence from Texas," *National Tax Journal* 57, no. 3 (2004): 571-588; and T. Downes and T. Pogue, "Adjusting School Aid Formulas for the Higher Cost of Educating Disadvantaged Students," *National Tax Journal* 47 (1994): 89-110.
- 153** These studies have some significant empirical advantages over production function studies in that they allow for corrections to be made for differences in the level of efficiency in producing outcomes across districts. This is possible in a cost-function framework because the spending variable is the dependent variable rather than one of the independent variables. When spending is the dependent variable, one can include in the model characteristics of school districts theoretically assumed to be related to greater inefficiency, such as less constrained fiscal capacity.
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Does Money
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Education?

Bruce Baker is a professor in the Graduate School of Education at Rutgers in New Jersey. From 1997 to 2008, he was a professor at the University of Kansas in Lawrence. He co-authored *Financing Education Systems*, a graduate-level textbook on school finance policy, and has written a multitude of peer-reviewed research articles on state school finance policy, teacher labor markets, school leadership labor markets, and higher education finance and policy. His recent work has focused on measuring cost variations associated with schooling contexts and student population characteristics, including ways to improve state school finance policies and local district allocation formulas (including weighted student funding) to better meet the needs of students. Baker has also consulted for state legislatures, boards of education, and other organizations on education policy and school finance issues, and has testified in state school finance litigation in Arizona, Kansas and Missouri.



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